

INDIAN INSTITUTE OF TECHNOLOGY MANDI
KAMAND, DISTT. MANDI – 175075 (HIMACHAL
PRADESH)



MINUTES OF 57TH BOARD OF ACADEMICS MEETING

VENUE	:	GUEST HOUSE (NC)CONFERENCE ROOM + ONLINE
DATE	:	10 th October, 2024 (THURSDAY)
TIME	:	03:00 PM

Following members attended the meeting

1.	Dean Academics	Prof. Aniruddha Chakraborty
2.	Associate Dean (Research)	Dr. Maheshreddy Gade
3.	Associate Dean (Courses)	Dr. P Anil Kishan
4.	Nominee-1: School of Computing and Electrical Engineering	Dr. Padmanabhan Rajan
5.	Nominee-2: School of Computing and Electrical Engineering	Dr. Gopi Shrikanth Reddy
6.	Nominee-1: School of Civil and Environmental Engineering	Dr. Sandip Kumar Saha
7.	Nominee-2: School of Civil and Environmental Engineering	Dr. Prasanna Rousseau
8.	Nominee-1: School of Mathematical and Statistical Sciences	Dr. Rajendra K Ray
9.	Nominee-1: School of Mechanical and Materials Engineering	Dr. Gaurav Bhutani
10.	Nominee-2: School of Mechanical and Materials Engineering	Dr. Deepak Sachan
11.	Nominee-1: School of Chemical Sciences	Dr. Bhaskar Mondal
12.	Nominee-2: School of Chemical Sciences	Dr. Garima Agrawal
13.	Nominee-1: School of Biosciences and Bioengineering	Dr. Sumit Murab
14.	Nominee-2: School of Biosciences and Bioengineering	Dr. Kasturi Prasad
15.	Nominee-2: School of Physical Sciences	Dr. Gargee Sharma
16.	Nominee-1: IKSHMA	Dr. Aniruddha Chakraborty
17.	Nominee-2: IKSHMA	Dr. Sumit Murab
18.	Nominee-1: Centre of Human Computer Interaction (HCI)	Dr. Dinesh Singh
19.	Nominee-2: Centre of Human Computer Interaction (HCI)	Dr. Deepak Sachan
20.	Nominee-2: Centre of AI and Robotics	Dr. Jagadeesh
21.	Deputy Registrar (Academics): Secretary	Mr. Suresh Rohilla
22.	Academic Affairs Secretary	Mr. Pourush Sharma
23.	PG Academic Secretary	Ms. Anugraha
24.	Research Affairs Secretary	Mr. Santu Shit

Following members could not attend the meeting

Sl. No.		Name	
1.	Chairman Senate Library Committee	Prof. Anjan Kumar Swain	Member
2.	Nominee-1: School of Physical Sciences	Dr. Arko Roy	Member
3.	Nominee-2: School of Mathematical and Statistical Sciences	Dr. Syed Abbas	Member
4.	Nominee-1: School of Humanities & Social Sciences	Dr. Rajeshwari Dutt	Member
5.	Nominee-2: School of Humanities & Social Sciences	Dr. Ramna Thakur	Member



6.	Nominee-1: Centre of AI and Robotics	Dr. Narendra Dhar	Member
7.	CnP Advisor	Dr. Kala Venkata Uday	Member
8.	Industry Member – 1	Dr. Nadeem Akhtar	Member

Special Invitee

Sl. No.	Name	
1	Dr. Tushar Jain	Head CCE
2	Dr. Dheeraj Dube	Asst. Prof., SMME
3	Dr. Bukke Ravindra Naik	Asst. Prof., SMME
4	Mr. Pavin S Samuel	JS, CCE
5	Dr. Saswata Adhikari	Asst. Prof., SMSS
6	Dr. Arnav Bhavsar	Chair, IKSMHA
7	Dr. Indu Joshi	Asst. Prof., SCEE
8	Krishna Mohan Parattu	Asst. Prof., SPS
9	Dr. Ravindra Kumar Yadav	Asst. Prof., SPS
10	Dr. Abhimanew Dhir	Asst. Prof., SCS
11	Dr. Qaiser Jahan	Asst. Prof., SMSS
12	Dr. Mrityunjay Doddamani	Chair, SMME

PART-A

(Issues discussed by the Board of Academics when the Student Members were present)

57.1 Confirmation of the minutes of 56th meeting of the Board of Academics:

The minutes of the 56th meeting of the Board of Academics held on 3rd July, 2024 were confirmed.

57.2 To consider proposal for revision of LMBA Curriculum:

The agenda item was not presented by the proposer and dropped.

57.3 To consider proposal for B.Tech. in General Engineering Curriculum:

The agenda item is deferred.

57.4 To consider proposal for minor revision in B.Tech. in Mathematics and Computing Curriculum:

Dr. Rajendra Kumar Ray, Nominee from SMSS presented the proposal for minor revision in B.Tech. in Mathematics and Computing. After due deliberations, the BoA approved the proposal and the same shall be reported to the Senate.

The modified proposal is placed as **Annexure – A**.

57.5 To consider proposal for additional electives courses for minor in Applied Physics:

Dr. Gargee Sharma presented the proposal for additional elective courses for Minor in Applied Physics. After due deliberations, the BoA approved the following courses and the same shall be reported to the Senate:

Course No.	Name of the Course
PH-507	X-rays as a probe to study material properties
PH-508	Magnetism and Magnetic Materials
PH-528	Introduction to General Relativity
PH-601	Mesosopic Physics and Quantum Transport
PH-603	Advanced Condensed Matter Physics
PH-604	Optical Properties of Solids
PH-605	Superconductivity
PH-606	Quantum Field Theory
PH-607	Physics of Ultracold Quantum Gases
PH-608	Computer assisted quantum mechanics
PH-609	Theory of quantum collision and spectroscopy
PH-612	Nuclear and Particle Physics
PH-701	Introduction to Molecular Simulations
PH-706	Introduction to Stochastic Problems in Physics
EP-502	Informatics for Materials Design

57.6 To consider proposal for courses for Double major in CSE:

The agenda item was not presented by the proposer and dropped.

57.7 To consider proposal for Minor in Robotics:



Dr. Jagadeesh presented the proposal for Minor in Robotics. After due deliberations, the BoA approved the proposal with minor modifications and the same shall be reported to the Senate.

The modified proposal is placed as **Annexure – B**.

57.8 To consider proposal for norms for Teaching Assistantship (TA) duty for research Scholars:

Associate Dean (Research) presented the proposal for Teaching Assistantship (TA) duty for research Scholars. After due deliberations, the BoA approved the proposal as follows and the same shall be reported to the Senate:

- The Teaching Assistantship for research scholars (MTech, MTech(R), and PhD) admitted under HTRA, UGC/CSIR-NET, and other equivalent schemes is 8 hours a week.
- The research scholars supported through sponsored research grants, and PMRF are exempted from the institute's TA duty.

Guidelines:

1. The respective schools assign TA duties for a theory or a laboratory course before the semester begins.
2. TA must report to the faculty in charge of the course/laboratory well in advance and be aware of his/her responsibilities.
3. The assistantship is also renewed every month, subject to good performance during the preceding month as a teaching/research assistant.
4. TA is required not to be absent from the tutorial/laboratory session. In case of unavoidable circumstances, TA need to provide replacement and the same must be informed to the teacher/course instructor in advance.
5. As a TA, the TA duty must be treated as an excellent opportunity to improve expertise in the technical content of the course, enhance communication skills, obtain hands-on experience handling experiments in the laboratory, and improve peer interactions.

57.9 To consider proposal for modification of guidelines for JRF to SRF and issues related to monthly scholarship for M.Tech(Research)/ M.Tech/I-PhD/PhD Scholars.

Associate Dean(Research) presented the proposal for modification/addition of guidelines for JRF to SRF and issues related to monthly scholarship for M.Tech(Research)/ M.Tech/I-PhD/PhD Scholars.

As per the current norms/guidelines for JRF to SRF and issues related to monthly scholarship for M.Tech(Research)/M.Tech/I-PhD/PhD Scholars as notified vide notification No. IIT mandi/Acs/Senate/2022/4536-41 dated 16/11/2022 point NO. (iii) *The monthly scholarship of PhD/i-PhD/M.Tech. students (All categories of full time) will be released based on the attendance record of the student by of every month. Therefore, students must mark the attendance on all working days. Based on the absent of the student in a month, commensurate amount from the monthly fellowship will be deducted. If a thesis supervisor or TA supervisor is not satisfied with the performance of the student in any month, he/she must explicitly communicate his/her recommendation for unsatisfactory performance to academic section by the end of the month, otherwise it will be considered satisfactory by default. School office will compile the data of attendance and communicate to academic section every month.*

In addition, following may be included:

"If the performance of the scholar in the particular month is not satisfactory, the scholarship for that month will neither be paid in that month nor the subsequent months in any case."

After due deliberations, the BoA recommended the proposal for the consideration of Senate and its approval.

57.10 To consider proposal for uploading the Ph.D. Thesis on Shodhganga portal.

Associate Dean (Research) presented the proposal for uploading the Ph.D. Thesis on Shodhganga portal. After due deliberations, the BoA recommended the proposal as follows for the consideration of Senate and its approval:

The thesis will be uploaded to the Shodhganga portal after the viva voce. If required, the scholar can request additional time to upload it at the time of final submission, with proper justification from the supervisor. With the approval of the competent authority, up to one year relaxation may be provided.

57.11 To consider proposal for implementation of Academic Bank of Credits (ABC):

Associate Dean (Courses) presented the proposal on behalf of Dr. Atul Dhar, for implementation of Academic Bank of Credits (ABC). After due deliberations, the BoA recommended the proposal with minor modifications for the consideration of Senate and its approval.

The modified proposal is placed as **Annexure – C**.

57.12 To consider proposal for Credit-linked Micro-specialization programs under CCE:

Head CCE presented the proposal for Credit-Linked Micro Specialization programme under CCE. After due deliberations, the BoA suggested to constitute a committee and provide recommendations to the Dean (Academics).

57.13 To consider proposal for Dual Degree in IIT Mandi B.Tech. EE and VLSI students to have one year Master Degree in Sorbonne University (UPMC), Paris France:

Dr. Padmanabhan Rajan presented the proposal Dual Degree in IIT Mandi B.Tech. EE and VLSI students to have one year Master Degree in Sorbonne University (UPMC), Paris France. After due deliberations, the BoA suggested to present complete proposal to the Senate for consideration.

57.14 To consider proposal for modification in Cooling off period norm in Ph.D./M.Tech (Research) Ordinance:

The agenda item is deferred.

57.15 To consider proposal for documentation required for Part-time Ph.D. and MS (Research) admissions in Music and Musopathy in IKSMHA

Nominee from IKSMHA, presented the proposal for documentation required for Part-Time Ph.D. and M.S. Admissions in Music and Musopathy in IKSMHA. After due deliberations, the BoA suggested to constitute a committee for the presented proposal and submit its recommendations. Also, BoA suggested to refer to similar Institutes like Visva Bharti University etc.

57.16 To consider proposal for elective course proposal for M.Sc Chemistry+ Ph.D

Dr. Abhimanew Dhir presented the proposal for elective courses for M.Sc Chemistry +Ph.D. After due deliberations, the BoA approved the following courses and the same shall be reported to the Senate:

Sl.No.	Course No.	Course Name	Credits
1.	CY-558	Inorganic Chemistry for Sustainability	3-0-0-3

The course description is placed at **Annexure -D**.

57.17 To consider the new courses from SOM:

The agenda item was not presented by the proposer and dropped.

57.18 To consider the new courses from SMSS:

BoA approved the following course from SMSS in new format and the same shall be reported to the Senate:

Sl.No.	Course No.	Course Name	Credits
1.	MA-575	Complex Analysis	3-1-0-4
2.	MA-600	Research Methodology	1-0-0-1

The course descriptions are placed as **Annexure- E**.

57.19 To consider the new courses from SCENE:

BoA approved the following course from SCENE in new format and the same shall be reported to the Senate:

Sl.No.	Course No.	Course Name	Credits
1.	CE-520	Environmental Reaction Modeling	3-0-0-3
2.	CE-525	Advanced Transportation Engineering	3-0-1-4
3.	CE-526	Critical Zone Science	2-1-0-3
4.	CE-527	Advanced Pavement Engineering	3-0-2-4
5.	CE-528	Design of Masonry Structures	3-0-0-3
6.	CE-352P	Transportation Engineering Laboratory	0-0-2-1

The course descriptions are placed as **Annexure- F**.

57.20 To consider the new courses from SMME:

BoA approved the following course from SMME in new format and the same shall be reported to the Senate:

Sl.No.	Course No.	Course Name	Credits
1.	IC-241	Materials Science for Engineers	3-0-0-3
2.	ME-210P	Fluid mechanics lab	0-0-2-1
3.	ME-316	Automotive Engine Design	3-0-0-3
4.	ME-527	Biofluid Dynamics	3-0-0-3
5.	ME-600	Research Methodology	1-0-0-1
6.	ME-630	Machine Learning for Engineers	2-0-2-3

7.	MT-201	Physics of Solids	3-0-0-3
8.	MT-202	Applied Quantum Mechanics	3-0-0-3
9.	MT-203	Materials Synthesis and Characterization	3-0-2-4
10.	MT-204	Thermodynamics and Kinetics of Materials	3-0-0-3
11.	MT-205	Functional Properties of Materials	3-0-2-4
12.	MT-206	Extraction and Materials Processing	3-0-2-4
13.	MT-301	Phase Transformation	3-0-0-3
14.	MT-302	Transport Phenomena	3-0-0-3
15.	MT-303	Computational Materials Science	3-0-2-4
16.	MT-304	Mechanical Behavior of Materials	3-0-2-4
17.	MT-501	Energy Conversion and Storage Technologies	3-0-0-3
18.	MT-502	Recycling and Circular Economy	3-0-0-3
19.	MT-503	Semiconductor Materials and Devices	3-0-0-3
20.	MT-504	Powder Metallurgical Processing of Materials	3-0-0-3
21.	MT-505	Thin Film Technology	3-0-0-3
22.	MT-506	Biomaterials	3-0-0-3
23.	MT-507	Modelling and Simulations in materials science	3-0-0-3
24.	MT-508	Iron and Steel Making	3-0-0-3
25.	MT-509	Hydrogen Energy	3-0-0-3
26.	MT-510	Colloids and Interfaces	3-0-0-3
27.	MT-511	Sensor Materials and Technologies	3-0-0-3

The course descriptions are placed as **Annexure- G.**

57.21 To consider the new courses from CHCI:

BoA approved the following course from CHCI in new format and the same shall be reported to the Senate:

Sl.No.	Course No.	Course Name	Credits
1.	HC-600	Research Methodology	1-0-0-1

The course descriptions are placed as **Annexure- H.**

57.22 To consider the proposal for course codes for M.Sc. Chemistry:

Dr. Garima Aggarwal presented the proposal M.Sc. Chemistry curriculum applicable from August, 2025 batch onwards for consideration of the BoA. The BOA approved the proposal with minor modifications and the same will be reported to the Senate.

The proposal is placed as **Annexure-I.**

57.23 To consider the proposal for revision of Course list for Minor in Intelligent Systems.

The agenda item was not presented by the proposer and dropped.

57.24 To consider the proposal for revision of Course list for Minor in Computer Science Engineering:

The agenda item was not presented by the proposer and dropped.

57.25 To consider the new courses from SCEE:

BoA approved the following course from SCEE in new format and the same shall be reported to the Senate:

Sl.No.	Course No.	Course Name	Credits
1.	CS-520	Introduction to Quantum Computing	2-0-1-3
2.	CS-510	Randomized Algorithms	4-0-0-4

The course descriptions are placed as **Annexure- J**.

57.26 To consider the new courses from SPS:

BoA approved the following course from SPS in new format and the same shall be reported to the Senate:

Sl.No.	Course No.	Course Name	Credits
1.	PH-550	Introduction to Quantum Optics	3-0-0-3
2.	PH-579	Quantum Computation and Information	3-0-0-3

The course descriptions are placed as **Annexure- K**.

57.27 To consider proposal for Financial support for M.Tech. (Research) Scholars:

Proposal dropped.

Any other item with the permission of the Chair:

(1) To consider the new courses from SHSS:

BoA approved the following course from SPS in new format and the same shall be reported to the Senate:

Sl.No.	Course No.	Course Name	Credits
1.	HS-110	Japanese Language for Beginners	3
2.	HS-111	Japanese Language for Daily Life	3

The course descriptions are placed as **Annexure- L**.

-NIL-

PART-B

(Issues discussed by the BoA without the Student Members being present)

-NIL-

The meeting ended with a vote of thanks to and by the Chair.

Anne
28/10/24
Chairman, Board of Academics

[Signature]
Secretary, Board of Academics

Annexure A

Proposal for B. Tech. in Mathematics and Computing



**School of Mathematical and Statistical Sciences
(SMSS)**

Indian Institute of Technology Mandi

B. Tech. in Mathematics and Computing
in
School of Mathematical and Statistical Sciences (SMSS)

I. Program Description:

The Bachelor of Technology (B.Tech.) program in Mathematics and Computing is a comprehensive course that integrates the principles of mathematics and computing. This program is designed to equip students with a strong foundation in mathematics, computing, and computational thinking, enabling them to develop and apply analytical and problem-solving skills in a variety of fields in science and engineering. The aim of this program is two-fold, one to provide strong mathematical background for strong logical thinking, and other to prepare students for strong computing skills. The mathematics part will also give them strong foundation which enable them to be leader in the field. The program is design in such way that after important foundational courses, students can choose courses as per their interest in a particular domain. The program aims to produce graduates who are well-versed in a broad range of mathematical and computational concepts, techniques, and tools. With the help of these skills, students can handle complex real-world problems. It will also enhance the ability of the students looking for solving new challenges in the society. With a focus on both theoretical and practical aspects of mathematics and computing, this program prepares students for a wide range of careers in industries, academia and research & development.

2. Credit Structure of the program.

The typical credit structure of the institute will be followed as shown below.

Division	Sub division	Credits
Institute Core	IC Compulsory	39
	IC Baskets	06
	Humanities and Social Sciences (HSS)	12
	Indian Knowledge System (IKS)	03
Discipline	Discipline Core (DC)	51
	Discipline Electives (DE)	15
Electives	Free Electives (FE)	22
	Major Technical Project (MTP)	08
	Interactive Socio Technical Practicum (ISTP)	04
	TOTAL	160

The credit structure will be followed as per the existing norms of the institute. Out of 160 credits, 52 credits will be dedicated to discipline core courses and 15 credits will be assigned for discipline electives. Total of 67 credits will be maintained for discipline (i.e., DC (52 credits) and DE (19 credits)) courses while the rest of the credits will be kept for IC and other institute level courses (93 credits). The semester wise distributions of all the courses along with credits details are given below:

B.Tech. in Mathematics and Computing –1st Semester						
S.No	Code	Course Name	Lecture	Tutorial	Practical	Credit
1	ICXXX	Calculus	2	0	0	2
2	ICXXX	Complex variables and Vector Calculus	2	0	0	2
3	IC140	Engineering Graphics	2	0	3	4
4	IC152	Introduction to Python and Data Science	3	0	2	4
5	IC136	Understanding Biotechnology & its Applications (basket - 1)	3	0	0	3
6	IC253	Programming and Data Structures (basket-2)	3	0	0	3
7	YYXXX	IKSMHA Course	3	0	0	3
8	ICXXX	Data Structure & Algorithm Lab	0	0	2	1

Total Credits: 22

B.Tech. in Mathematics and Computing –2nd Semester						
S.No	Code	Course Name	Lecture	Tutorial	Practical	Credit
1	ICXXX	Linear Algebra	2	0	0	2
2	ICXXX	ODE & Integral Transforms	2	0	0	2
3	IC161	Applied Electronics	3	0	0	3
4	IC 161P	Applied Electronics Lab	0	0	3	2
5	IC252	Probability and Statistics	3	0	2	4
6	ICXXX	Foundations of Design Practicum	1	0	6	4
7	IC221P	Physics Practicum	0	0	3	2
8	HSXXX	HSS Course	3	0	0	3

Total Credits: 22

B.Tech. in Mathematics and Computing –3rd Semester						
S.No	Code	Course Name	Lecture	Tutorial	Practical	Credit
1	IC201P	Design Practicum	0	0	6	3
2	IC272	Machine Learning	2	0	2	3
3	MAXXX	Real and Complex Analysis	2.5	0.5	0	3
4	CS208	Mathematical Foundation of Computer Sciences	3	1	0	4
5	MA513	Ordinary Differential Equation	3	1	0	4
6	FE	Free Elective				4

Total Credits: 21

B.Tech. in Mathematics and Computing – 4th Semester						
S.No	Code	Course Name	Lecture	Tutorial	Practical	Credit
1	MA522	Partial Differential Equation	3	1	0	4
2	CS201	Computer Organization	3	0	0	3
3	CS201P	Computer Organization Laboratory	0	0	2	1
4	MA523	Numerical Analysis	3	1	0	4
5	MA515	Applied Mathematics Programming	3	1	0	4
6	HSXXX	HSS Course				3
7		Discipline Elective Basket -I (Foundation Module)				3

Total Credits: 22

B.Tech. in Mathematics and Computing – 5th Semester						
S.No	Code	Course Name	Lecture	Tutorial	Practical	Credit
1	MAXXX	Matrix Computation & Lab	3	0	2	4
2	CS304	Formal Language and Automata Theory	3	0	0	3
3	CSXXX	Design of Algorithms	3	0	2	4
4	DE	Discipline Elective				3

5	MAXXX	Mathematical Modelling	3	0	0	3
6	HSSXXX	HSS or Management course				3
7	MAXXX	Reverse Engineering				1

Total Credits: 21

B.Tech. in Mathematics and Computing – 6th Semester

S.No	Code	Course Name	Lecture	Tutorial	Practical	Credit
1	CS207	Applied Databases Practicum	0	0	0	2
2		Discipline Elective Basket-II (Advance Modelling Module)	3	0	0	3
3	MA609	Numerics of PDE	3	0	0	3
4	FE	Free Elective	3	0	0	3
5	HSSXX	HSS or Management course				3
6	ISTP	ISTP				4
7	MAXXX	Applied Graph Theory	3			3

Total Credits: 21

B.Tech. in Mathematics and Computing – 7th Semester

S.No	Code	Course Name	Lecture	Tutorial	Practical	Credit
1	DE	Discipline Elective				3
2	FE	Free Elective				3
3	FE	Free Elective				3
4	MTP-1	MTP-1				4
5	IC 010	Internship				2

Total Credits: 15

B.Tech. in Mathematics and Computing –8th Semester

S.No	Code	Course Name	Lecture	Tutorial	Practical	Credit
1	DE	Discipline Elective				3
2	FE	Free Elective				3
3	FE	Free Elective				3
4	FE	Free Elective				3
5	MTP-2	MTP-2				4

Total Credits: 16

Grand Total: 160 credits for B.Tech. in Mathematics and Computing

Two discipline elective baskets are proposed for two discipline electives to give a flexibility to the students to choose their free electives in a particular direction.

Discipline Elective Basket I: Foundation Module

Course Numbers	Course Titles	Credits
MA549 (3)	Abstract Algebra	3
MA521 (4)	Functional analysis	4
MA528 (4)	Measure Theory	4
MA516 (4)	Topology	4
MA552 (3)	Number Theory	3

Discipline Elective Basket II: Advance Modelling Module

Course Number	Course Titles	Credits
MAXXX	Climate Modelling	
MA653 (4)	Computational Financial Modelling & Lab	4

MAXXX	Modelling of infectious disease	
MAXXX	Mathematical Image Processing	
MAXXX	Mathematical Control Theory	
ME620 (3)	Modelling and Simulation	3
MA-705(3)	Modelling Population Dynamics	3

Students can take other discipline electives from the proposed list of the discipline electives. The list will be revised/modified time to time to include new discipline electives.

Discipline Electives: Discipline electives will be provided according to the requirement of the students and the availability of the faculties. The list of discipline electives is attached herewith. More elective courses will be added time to time as required. Overall, the credits distribution is as follows:

Sl. No.	Course Name	Credits
1.	Statistical Data Analysis	3
2.	Mathematical Foundations of Financial Engineering	3
3.	Numerical Methods in Quantitative Finance	3
4.	Computational Fluid Dynamics	3
5.	Financial Engineering	3
6.	Stochastic Calculus for Financial Engineering	3
7.	Semigroup of Bounded Linear Operators	3
8.	Topics in Semigroup Theory	3
9.	Fractional Differential Equations	4
10.	Compiler Design	4
11.	Artificial Intelligence	3
12.	Computer Networks	4
13.	Operating Systems	4
14.	Time Series Analysis	3
15.	Mathematical Method for Signal Processing	4
16.	Computer Vision	4
17.	Digital Image Processing	3
18.	Advanced Data Structure and Algorithms	4
19.	Speech Processing	3
20.	Pattern Recognition	3
21.	Soft Computing	3
22.	Bioinformatics	4
23.	Biomechanics	4

24.	Genetic Engineering	4
25.	Applied Biostatistics	4
26.	Transportation Engineering	3
27.	Transporting Engg. Lab	1
28.	Hydraulics Engineering	3
29.	Paradigms of Programming	4
30.	Information Systems and Databases	4
31.	Data Handling and Visualization	3
32.	Computing Systems for Data Processing	4
33.	Times Series Analysis and Applications / Bayesian Data Analysis and Applications	3
34.	Big Data: Management and Analytics	4
35.	Network Theory	3
36.	Signal & Systems	3
37.	Control Systems	4
38.	Computational Methods for Engineering	3
39.	Engineering Thermodynamics	4
40.	Fluid Mechanics	3
41.	Heat Transfer	3
42.	System Dynamics and Control	3
43.	Fluid Mechanics Lab	1
44.	Heat Transfer Lab	1
45.	Cellular Automata	3
46.	Computational Modeling of Social Systems	3

Total- 160 Credits

Discipline Core- 51 Credits

Discipline Elective- 15 Credits (out of which 6 credits would be chosen from two baskets)

Free Electives- 22 Credits

Institute Core & other required courses: 72

Minor in Robotics

A Minor in Robotics is proposed to be open to B. Tech. and B.Tech. + M.Tech. dual degree students at IIT Mandi.

This minor consists of a curriculum in robotics, which is organized as core and elective courses of 12 credits. The successful completion of the minor requires 6 credits of core courses and a minimum of 6 credits of elective courses. The 6 credits of core courses will be earned against the following 2 core courses:

1. AR 501/ ME 452: Robot Kinematics, Dynamics, and Control
2. AR 503: Mechatronics

To obtain a Minor in Robotics, students need to maintain a minimum GPA of 7.0 in the dedicated 12 credits that they have taken to fulfill the course requirement of the Minor programme. The remaining 6 credits will be earned from any of the remaining courses of the basket listed below.

1. AR 502: Advanced Design Practicum
2. AR 504: Robot Programming
3. AR 505: Principles of Robot Autonomy
4. AR 506: Cognitive Robotics
5. AR 507: Probabilistic Robotics
6. AR 508: Marine Robotics
7. AR 509: Deep Learning for Robotics
8. AR 510: Underactuated Robotics
9. AR 511: Autonomous Mobile Robots
10. AR 512: Rapid Prototyping and Tooling
11. AR 513: Unmanned Aerial Systems (UAS)
12. AR 514: Vision and Learning Based Control
13. AR 515: Sensors and State Estimation
14. AR 519/EE 555: Intelligent Control System

Annexure C

Academic Bank of Credit (ABC)

The Academic Bank of Credit (ABC) is a digital platform proposed by India's National Education Policy (NEP) for 2020. Its purpose is to make it easier for students to store and transfer academic credits earned at different higher education institutions. This initiative seeks to create a more flexible and multidisciplinary education system by allowing students to earn credits from a variety of institutions and apply them toward a degree or diploma.

Key features:

1. Credit Accumulation and Transfer: Students can earn credits from a variety of recognized institutions and apply them toward their final degree or certification.
2. Flexibility: It allows students to create their learning paths and take courses from a variety of HEIs.
3. Enhanced Mobility: Students can transfer between institutions without losing any credits.
4. Multi-Entry and Exit Points: Allows students to take breaks and resume their studies as needed.

Source: <https://www.abc.gov.in/statistics.php>

Objectives:

- To give students flexibility and mobility in their academic pursuits.
- To allow students to accumulate and transfer credits seamlessly between recognized institutions.
- Promote interdisciplinary and multidisciplinary learning.
- To attract good students from other CFTIs
- Compliance with new education policy (NEP) mandates.

Proposal to implement Academic Bank of Credit (ABC) at IIT Mandi:

This policy outlines the guidelines for accepting and managing academic credits at IIT Mandi through Academic Bank of Credit (ABC), which are consistent with the National Education Policy (NEP) 2020. This policy will cover all undergraduate and postgraduate programs at IIT Mandi.

a. Enrollment with ABC through National Academic Depository (NAD)

Status Update (Oct 2024): IIT Mandi has already created 1191 student IDs on the ABC platform, but it lacks credit data. (<https://www.abc.gov.in/statistics.php>). It is suggested that data of the students should be added to these IDs and necessary infrastructure for the same should be created in the Academic Office. Currently the infrastructure wing of NAD has stopped the process of data collection and DR Academic is in contact with NAD team for a planned visit of NAD team to IIT Mandi for understanding the resource requirements for updating the data of IIT Mandi students on NAD. The degrees of all the degree recipients for the convocation concluded in September 2024 have already been uploaded to the NAD.

The academic office of IIT Mandi will maintain the semesterwise transcript of all registered students on NAD.

b. Entry with Credit transfer

- For admissions to UG programmes governed by JEE mains and advance, acceptance of already completed credits will not be allowed through ABC.

- IIT Mandi will allow admission in PG courses along with acceptance of completed credits according to the eligibility criteria mentioned below:

Eligibility:

- The requested academic credits earned from recognized CFTIs, Institutes of National Importance institutions that participate in the ABC scheme, will be considered for credit transfer during admissions, provided they are not used for any degree award.
- Credits from other institutions may be evaluated for equivalence with IIT Mandi's course offerings by respective schools/centers. A committee of faculty members from relevant schools/centers will evaluate the equivalence at the time of admission for students who want to claim credit(s) for previously completed courses from institutions other than CFTIs, Institutes of National Importance.

c. Credit Transfer Mechanism and Guidelines:

- Students must submit their ABC ID to the academic office at IIT Mandi, along with a request for credit transfer, the intended use, the degree he or she is pursuing at IIT Mandi, and the relevance of these courses to degree requirements while submitting the application for a degree programme at IIT Mandi.
- Based on the school admission committee recommendations, the relevant and eligibility-verified credits will be added to the student's academic record at IIT Mandi once the academic office confirms their authenticity.
- The final project or thesis credit must be earned at IIT Mandi.
- A maximum of 50% of the total credits required for a degree at IIT Mandi can be obtained/transferred from other institutions.

Committee Members: Dr. [Aditya Nigam](#), Dr. Dericks P Shukla, Dr. [Shyam Kumar Masakapalli](#), Dr. P Anil Kishan, Dr. Atul Dhar

Recommendations are submitted to Dean Academics for Further Processing



IIT Mandi
Proposal for a New Course

Course Number :CY558
Course Name : Inorganic Chemistry for Sustainability
Credit Distribution : 3-0-0-3
Intended for :PG and PhD Level
Prerequisite : None
Mutual Exclusion : None

1. Preamble: Inorganic Chemistry elucidates fundamental properties of elements and deals with integrating earth's inorganic resources into society. From past few decades, inorganic chemists have laid foundation of sustainable use of elements which is unavoidable and immediate need. The focus is on products and processes which are environmentally benign recognizing sustainability as a goal. The course demonstrates few important topics at intersection of inorganic chemistry and sustainability.

2. Course Modules with quantitative lecture hours:

Module 1: Introduction (5 hours)

Introduction to sustainability, life cycle sustainability assessments, social dimensions of sustainability, life cycle costing in sustainability assessment-a case study of remanufactured alternators, valorization, greenhouse gases and greenhouse effect, greenhouse gas emission associated with primary metal production, recycling, downcycling and upcycling of metals, modern trends in inorganic analysis.

Module 2: Solvent systems for sustainability (5 hours)

Bio-derived solvents, water as a solvent, liquid N₂, supercritical CO₂, CO₂ expanded liquids, CO₂ switchable solvents.

Module 3: Inorganic waste treatment (6 hours)

Recovery of gold from sewage sludge, recovery of gold carbon-based materials, carbon in pulp method: a case study from Japan, earth recycling from neodymium-iron-boron permanent

magnets, development of recycling technology for rare earth metals by Hitachi: case study, adsorption methods for metal removal.

Module 4: Sustainable water remediation

(9 hours)

Reasons and problems related to wastewater, bioremediation, zeolites as treatment agents for wastewater, modified silica gels as chelating sorbents, ionic liquids for water remediation, inorganic hybrid materials for water remediation, adsorption methods for water treatment, water treatment by electrocoagulation.

Module 5: Sustainable inorganic catalysts for organic transformations (7 hours)

Inorganic catalyst (Re, Ti, Mn, W) for epoxidation, catalytic epoxidation of oils, fatty derivatives and terpenes, (Al, K and Fe) based catalysts for carbonate synthesis, fluorous catalysts for hydrocarbon oxidation. Metal oxide (CuO, RuO₂, WO₃, CeO₂) supported catalytic transformation involving amination, electrophilic cyclization, C-C coupling and hydrogenation.

Module 6: Sustainable synthesis with microwave irradiation

(5 hours)

Microwave assisted controlled organic synthesis, microwave assisted polymerization, synthesis of inorganic solids using microwaves, microwave assisted nanoparticle synthesis.

3. Textbooks

1. Sustainable Inorganic Chemistry, Wiley, Ed. David A. Atwood (2016).
2. Sustainable Industrial Chemistry, Wiley-VCH Verlag GmbH & Co KGaA, F. Cavani, G. Centi, S. Perathoner, F. Trifiro (2009).

4. References

1. Introduction: Sustainable Chemistry, Chemical Reviews, 2018, 118, 369–371.
2. Sustainable Inorganic Chemistry: Metal Separations for Recycling, J. J. M Nelson; E. J. Schelter, Inorganic Chemistry, 2019, 58, 979–990.
3. The Materials Science behind Sustainable Metals and Alloys, *Chem. Rev.*, 2023, 123, 2436–2608.
4. New Technology for Gold Recovery, JOGMEC report, Japan Oil, Gas and Metal National Corporation (JOG-MEC), Tokyo, 1995.
5. Insight; <http://www.51report.com/research/3051099.html>

6. E. M. Schau, M. Traverso, A. Lehmann and M. Finkbeiner, *Sustainability* 2011, 3, 2268.

**5. Similarity with the existing courses:
(Similarity content is declared as per the number of lecture hours on similar topics)**

S. No.	Course Code	Similarity Content	Approx. % of Content
1.	NA	NA	NA

6. Justification of new course proposal if cumulative similarity content is >30%:

NA

Approvals:

Other Faculty interested in teaching this course: –

Proposed by: Dr. Abhimanew Dhir School: Chemical Sciences

Signature:



Date: 30.09.2024

Recommended/Not Recommended, with Comments:

_____ **Chairperson, CPC**

Date: _____

Approved / Not Approved

_____ **Chairperson, BoA**

Date: _____



IIT Mandi

Proposal for a New Course

Course number : MA-575
Course Name : Complex Analysis
Credit Distribution : (3-1-0-4)
Intended for : M.Sc./M.Tech./PhD/B.Tech
Prerequisite : None
Mutual Exclusion : (None)

1 Preamble: The objective of this course is to introduce the students with the concept of functions of complex variables. Complex analysis is a branch of mathematical analysis that investigates functions of complex variables. Complex analysis is backbone of many branches of mathematics including algebraic geometry, number theory, analytic combinatorics etc.

2 Course Modules with quantitative lecture hours:

Module 1: Complex numbers and the point at infinity, Polar representation, logarithmic and trigonometric functions, Analytic functions, Cauchy-Riemann conditions, Power series, Harmonic conjugates, Mobius transformations, Mappings by elementary functions, Liouville's theorem and its applications, Conformal mappings. **(14 Hours)**

Module 2: Index of a closed curve, Cauchy's theorem, Cauchy integral formula, Power series representation of analytic functions, Open mapping theorem, Goursat's theorem. Uniform convergence of sequences and series. Taylor and Laurent series. **(12 Hours)**

Module 3: Isolated singularities and residues, Residue theorem and its application to evaluation of real integrals. Zeroes and poles, Maximum Modulus Principle and

Schwarz's lemma, Meromorphic functions, Argument Principle, Rouché's theorem, **(16 Hours)**

3 Text books:

- 1 J.B. Conway, Functions of One Complex Variable, 2nd Edition, Narosa, New Delhi, 1978.**
- 2 T.W. Gamelin, Complex Analysis, Springer International Edition, 2001.**
- 3 J.W. Brown and R.V. Churchill "Complex variables and applications" 9th edition, McGraw Hill Higher Education.**

4 References:

- 1 R. Remmert, Theory of Complex Functions, Springer Verlag, 1991.**
- 2 A.R. Shastri, An Introduction to Complex Analysis, Macmillan India, New Delhi, 1999.**
- 3 E.M. Stein and R. Shakarchi, Complex analysis, Princeton lecture series in analysis.**
- 4 M.Thamban Nair, Complex analysis online notes, <https://home.iitm.ac.in/mtnair/ca.pdf>**

**5 Similarity with the existing courses: None
(Similarity content is declared as per the number of lecture hours on similar topics)**

	S. No.		Course Code	Similarity Content

Approvals:

Other Faculty interested in teaching this course: – Dr. Qaiser Jahan, Dr. Saswata Adhikari, Dr. Samir Shukla.

Proposed by: Dr. Sampat Kumar Sharma

School: SMSS

Signature:

Date: 25th April, 2023.

Recommended/Not Recommended, with Comments:

Chairperson, CPC

Date:_____

Approved / Not Approved

Chairperson, BoA

Date:_____

Course Name	:Research Methodology
Course Number	:MA-600
Credit	:1-0-0-1
Prerequisites	:NA
Students intended for	:M.Sc/Ph.D.
Elective or core	:Core
Semester	:Odd/Even

Preamble:

This course aims to provide students with a thorough understanding of the research process within the field of mathematics. It is designed to develop students' abilities to conduct high-quality research, critically assess existing academic work, and present their findings effectively. Emphasizing various research methodologies, the course also highlights the importance of ethical practices in research and offers practical experience in technical writing using LaTeX and mathematical software.

Expected Outcomes:

After successful completion of the course students

- **Understanding Research:** Students will gain a thorough understanding of the research process in mathematics, from problem identification to conclusion.
- **Technical Writing:** Students will develop strong skills in technical writing, enabling clear and precise communication of mathematical research.
- **Proficiency in LaTeX and Mathematical software:** Students will become proficient in using LaTeX and mathematical software for creating well-structured and professional research documents.

Course modules with Quantitative lecture hours

Module 1: Introduction to research

(2 Lectures)

- Defining research: Characteristics and objectives
- Research and the scientific method
- Various research methodologies:
 - Descriptive vs. Analytical research
 - Applied vs. Fundamental research
 - Quantitative vs. Qualitative research
 - Conceptual vs. Empirical research
- The research process:
 - Formulating and defining a research problem
 - Developing research questions
 - Differentiating between research methods and research methodology

Module 2: Literature review and hypothesis development

(1 Lectures)

- Conducting a literature review:
 - Reviewing concepts and theories and finding the research gaps.
- Hypothesis development:
 - Identifying sources and characteristics of hypotheses
 - Understanding the role of hypotheses in research
 - Methods for testing hypotheses

Module 3: Research communication

(2 Lectures)

- Writing and structuring research papers
- Preparing and delivering research presentations
- Crafting abstracts and summaries
- Group discussion
- Fear of rejection

Module 4: Research ethics

(2 Lectures)

- Informed consent and ethical considerations
- Maintaining confidentiality and privacy
- Avoiding plagiarism and ensuring proper attribution
- Ethical data use and management
- Collaboration and ethical practices in joint research

Module 5: LaTeX for academic writing

(2 Lectures)

- Introduction to LaTeX: Basic commands and structure
- Writing mathematical equations and symbols
- Organizing documents with sections, tables, and figures
- Creating bibliographies and managing citations
- Customizing document formats for research publications

Module 6: Technical writing and research documentation

(3 Lectures)

- Writing research articles
- Structuring and writing research projects
- Writing theses and dissertations
- Authoring books and writing reviews (e.g., book reviews, case reviews)
- Understanding the criteria for high quality research

Module 7: Citation methods and research integrity

(2 Lectures)

- Citation Techniques:
 - Footnotes, endnotes, and in-text citations
 - Compiling and formatting bibliographies
- Ethical considerations in research and citation
- Proper application of citation rules and guideline

Text Books:

1. Research Methodology: An Introduction by Wayne Goddard, Stuart Melville. Juta and Co. Ltd. 2007.
2. LaTeX Beginner's Guide - Second Edition by Stefan Kottwitz, Packt Publishing Ltd. 2011.

Reference Book:

1. Advanced Research Methodology by R. Barker Bausell. Scarecrow Press 2013.
2. Research Methodology: A Guide for Researchers in Management and Social Sciences by Bill Taylor, Gautam Sinha, Taposh Ghoshal. Prentice-Hall of India Private Limited, New Delhi 2006.
3. LaTeX Graphics with TikZ: A practitioner's guide to drawing 2D and 3D images, diagrams, charts, and plots by Stefan Kottwitz, Packt Publishing Ltd. 2023.

Similarity Content Declaration with Existing Courses:

S. No.	Course code and title	Similarity content	Approx. % of content	Remarks
1.	BY 600: Research Methodology RM 510: Research Methodology HS 600: Research Methodology RM 600: Research Methodology RM 510 : Research Methodology PH 600: Research Methodology IK 509: Research Methodology CE 600: Research Methodology for Civil Engineering	Introduction, Literature review, Technical writing	10%	Minor overlap
2.	HS 600: Research Methodology RM 510: Research Methodology PH 600: Research Methodology IK 509: Research Methodology	Research ethics	5%	Minor overlap
3.	PH 600: Research Methodology IK 509: Research Methodology RM 600: Research Methodology	Research communication	5%	Minor overlap

Justification for new course proposal if cumulative similarity content is > 30%:

Approvals:

Other Faculty interested in teaching this course: –

Proposed by: SMSS

School: SMSS

Signature:

Date: 25-09-2024

Recommended/Not Recommended, with Comments:

Chairperson, CPC

Date: _____

Approved / Not Approved _____

Date: _____

IIT Mandi
Proposal for a New Course

Course number : CE 520
Course Name : Environmental Reaction Modeling
Credit : 3
Distribution : 3-0-0-3
Intended for : PG, PhD
Prerequisite : IC230, CE519 or similar
Mutual Exclusion: None

1. Preamble:

The overall objective of this course is to learn to quantify the environmental biogeochemical processes using chemical reactions, numerical solutions and their application to real-world scenarios. In addition to the development of conceptual models, this course uses hands-on practice using Microsoft Excel spreadsheet, several open-source geochemical modeling programs (e.g., PHREEQC, Visual MINTEQ), as well as commercially available Geochemist's Workbench that is widely used over 1,000 universities and research facilities worldwide. Examples of topics covered in this course include microbial activity, surface chemistry, redox chemistry, contaminant mobilization, treatment and remediation within reaction models. This course is designed for undergraduate and graduate students in the fields of geochemistry, environmental engineering, contaminant hydrology, geomicrobiology, and numerical modeling.

2. Course Modules with quantitative lecture hours:

Module 1: Modeling basics (8 hours). This chapter introduces fundamentals of environmental modeling. First and the most critical step in developing environmental models is conceptualizing the system or process of interest in a useful manner; introduction to various environmental systems and the processes therein that can be quantitatively modeled; concepts of mass and energy transfer, thermodynamics. Environmental engineers and scientists now use quantitative models to understand sediment determine which contaminants will migrate from mine tailings and toxic waste sites, predict scaling in geothermal wells and the outcome of steam-flooding oil reservoirs, solve kinetic rate equations, manage injection wells, evaluate laboratory experiments, and study acid rain.

Module 2: Equilibrium of natural waters (14 hours). Chemistry of natural waters is of extreme importance for environmental scientists and engineers in terms of determining the quality of natural waters as well as for the treatment of contaminated water systems. This section provides insights on several steps in environmental modeling.

- a. **Equilibrium State.** This chapter discusses how can we express the equilibrium state of such a system; a direct approach to write each reaction that could occur among the

system's species, minerals, and gases; numerical solution for equilibrium state by determining a set of concentrations that simultaneously satisfy the mass action equation corresponding to each possible reaction.

- b. **Solving for equilibrium state.** The principal unknowns equations governing the equilibrium state of aqueous and solid environmental systems are the mass of water and concentrations of basic species, and moles of minerals in equilibrium. Many of these equations are often non-linear and hence cannot be solved using linear algebra. This chapter will focus on the special difficulties posed by the nonlinear forms of the governing equations and discuss how the Newton–Raphson method can be used in geochemical modeling to solve the equations rapidly and reliably.
- c. **Setting up a model.** The basis in reaction modeling includes water, each mineral in the equilibrium system, and each gas of known fugacity, and certain aqueous species. The basis serves two main purposes, each chemical reaction in the model is written in terms of members of the basis set. This chapter discusses how an environmental system can be expressed in terms of chemical reactions and quantitative parameters in the model.
- d. **Equilibrium model of natural waters.** This chapter will focus on constructing models of natural waters to predict processes like mineral dissolution, aqueous speciation of chemicals, minerals precipitation, gas dissolution and degassing, and pH of natural waters.
- e. **Redox disequilibrium.** Many chemical reactions in the environment are redox (oxidation-reduction) reactions and are extremely important for contaminant mobilization. In this chapter, modeling of redox sensitive elements in the environment (C, N, S, O, Fe, and other toxic metals) will be discussed. Inclusion of redox disequilibrium in chemical reaction modeling advances our abilities to predict behavior of contaminants in the environment.
- f. **Sorption and ion exchange.** An important consideration in constructing environmental chemical models, especially those applied to environmental problems, is to account for the sorption of aqueous species onto sediment surfaces. Because of their large surface areas and high reactivities, many components of a sediment – especially clay minerals, zeolites, metal oxides and oxyhydroxides, and organic matter – can sorb considerable masses. This chapter will focus on several simple models of ion sorption and exchange that can be applied within the context of an environmental reaction model. These models include distribution coefficients, Freundlich and Langmuir isotherms, and ion exchange theory.
- g. **Surface complexation.** The sorption models presented in the previous chapter are, however, too simplistic to be incorporated into a geochemical model intended for use under general conditions, such as across a range in pH. This chapter discusses a theory of surface complexation to describe hydrolysis and the mineral surface, account for electrical charge there, and provide for mass balance on the sorbing sites. Several surface complexations models will be constructed to predict the chemistry of natural water in equilibrium with minerals with specific reactive surface area.

Module 3: Reaction Processes (12 hours). This section overviews specific reaction processes such as mass transfer, polythermal reactions, geochemical buffering, kinetics of mineral dissolution and precipitation, redox kinetics, microbial kinetics, stable isotopes, transport in flowing groundwater, and reactive transport.

- h. **Mass transfer.** In this chapter we consider how to construct reactions paths that account for the effects of simple reactants, a name given to reactants that are added to or removed from a system at constant rates.

- i. **Polythermal reactions.** This chapter will focus on constructing reaction models that varies over temperature. A temperature varies as a function of reaction progress, is numerically modeled, and activity of solutes, stability of minerals, fugacity of gases involved in the system is calculated as a function of temperature.
- j. **Geochemical buffers.** Buffers are reactions that at least temporarily resist change to some aspect of fluid chemistry (e.g., pH buffers). This chapter focuses on constructing models of buffering reactions, both homogenous and heterogenous.
- k. **Kinetics of dissolution and precipitation.** This chapter focuses on modeling environmental reactions to predict how much time it'd take to reach a certain point along the reaction path, calculating relative rates of minerals in rocks, predicting chemistry of waters in equilibrium with certain rocks for a known amount of time, predicting future groundwater quality under known geochemical conditions, by incorporating reaction rate laws from the field of geochemical kinetics.
- l. **Redox kinetics.** The subject of this chapter is modeling the rates at which redox reactions proceed within the aqueous solution, or when catalyzed on a mineral surface or by the action of an enzyme.
- m. **Microbial kinetics.** This chapter focuses on how the microbial community catalyzes redox reactions, perhaps changing in size and composition as it does. The kinetics of such reactions are of special interest, because of the close relationship between geochemical conditions and microbial ecology. The microbes promote reactions that change geochemical conditions, many times significantly, and the geochemistry controls the nature of the microbial community that can exist in a given environment.

Module 4: Applied Reaction Modeling (8 hours). This section overviews specific examples of modeling environmental systems such as geothermal fluids, geothermometry, evaporation, sediment diagenesis, kinetics of water rock interaction, weathering, oxidation and reduction, waste injection wells, petroleum reservoirs, acid mine drainage, contamination and remediation, and microbial communities. These models of these (and other) environmental systems will be constructed throughout the duration of course using modeling programs like PHREEQC, Visual MINTEQ and Geochemist's Workbench. The concepts learnt in previous chapters will be utilized in construction of these models.

Laboratory/practical/tutorial Modules:

None

3. Text books:

- Bethke, C.M., 2022. Geochemical and biogeochemical reaction modeling. Cambridge university press.
- Parkhurst, D.L., and Appelo, C.A.J., 2013, Description of input and examples for PHREEQC version 3—A computer program for speciation, batch-reaction, one-dimensional transport, and inverse geochemical calculations: U.S. Geological Survey Techniques and Methods, book 6, chap. A43, 497 p., <https://doi.org/10.3133/tm6A43>

1. References:

- Gustafsson, J.P., 2011. Visual MINTEQ 3.0 user guide. KTH, Department of Land and Water Resources, Stockholm, Sweden.
- Appelo and Postma. Geochemistry, Groundwater, and Pollution.
- Merkel and Planer-Friedrich. Groundwater Geochemistry.
- Microsoft Excel
- USGS PHREEQC, open source (<https://www.usgs.gov/software/phreeqc-version-3>)
- Visual MINTEQ, open source (<https://vminteq.lwr.kth.se/>)
- Geochemist's Workbench, commercial (<https://www.gwb.com/>)
- GWB Academy: <https://academy.gwb.com/academy.php>.

1. Similarity with the existing courses:

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.		Course Code	Similarity Content	Approx. % of Content
1.	Environmental Sciences	IC 230	< 5%	<5%
2	Chemistry of Natural Waters	CE 519	<5%	<5%

6. Justification of new course proposal if cumulative similarity content is >30%:

Not applicable

Approvals:

Faculty interested in teaching this course:

Proposed by: Dr. Harshad V. Kulkarni

School: SCENE

Signature:



Date: 29/09/2023

The following external faculty (at least 2 faculty) provided the feedback and it was discussed among school/center faculty on.....

Sl. No	Faculty Name	Signature
1	Dr. Ashis Biswas (IISER Bhopal)	
2	Dr. Pradip Kalbar (IIT Bombay)	Comments and approval attached
3	Dr. Natalie Mladenov (San Diego State University)	
4	Dr. Matthew Kirk (Kansas State University)	

School Chair: रजनीशरमि ०९/१०/२५

School:

Date:

This proposal is reported inth Board of Academics on

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Comments of the Reviewers:

Comments of the Reviewers (Dr. Kulkarni's responses are in blue)

Dr. Ashis Biswas:

My overall comment: I think that this course should be an applied course, focusing more on solving specific problems (e.g., speciation, forward modelling, inverse modelling, surface complexation, reactive transport, etc.) using the proposed geochemical codes (PHREEQC, Visual MINTEQ, and Geochemist's Workbench), rather than the traditional lecture-based teaching. Students should spend more time with computer in solving problems rather than attending lectures.

I agree with this comment. The proposed course is intended to be more hands-on rather than traditional lecture based. This will be discussed with the department chair to arrange a classroom where students can have access to computers where they can practice these programs. The programs proposed to be used in this class are open source and students will be instructed to install these on their personal computers as well.

The book "Geochemistry, Groundwater, and Pollution" by Appelo and Postma and "Groundwater Geochemistry" by Merkel and Planer-Friedrich can be included in the course.

I agree and this book is added to the list of reference books.

Dr. Pradip Kalbar

Only if it's for Civil Engineering students, some topics seem bit not needed such as Applied Reaction modelling.

My response to the reviewer's comments:

Many thanks to Dr. Kalbar for his feedback on the two courses. Since there are no point-wise comments provided by this reviewer, no major changes were done in the course content. Regarding his general comment that since these courses are intended for civil/environmental engineering students, some topics seem "*bit not needed*", I would like to note that these courses are also intended for MS/MTech and PhD students in Civil/Environmental Engineering, and possibly for the students from other departments (e.g., Chemistry, Biology). Providing fundamental understanding of environmental processes will equip students for hands-on modelling which will help them in their careers.

Dr. Natalie Mladenov

It was a bit difficult to judge because I don't know the level of the course (grad undergrad?) or prerequisite courses (the two listed seem vague- are those courses or background?). The Chemistry of Natural Waters course is great.

Nothing to note / comment for this part.

The modelling course covers so many important processes. I could not tell if that course has a lab component. It seems that a lab with access to computers and software for the geochemical modelling is needed.

As of now, the course does not have a separate lab component. However, the programs to be used in this course will be made available to students for practice. The course will be held in a classroom equipped with computers, after the discussion with the department chair for the availability of such classroom for this course.

Also, is this course an upper-level course? I think with the advanced content it should be. This course is intended for upper level UG, MS/MTech/PhD students. Depending upon the class composition (% of UG and PG students), slight modifications in course requirements (exams, projects etc.) will be made to suite the needs of UG and PG students, and will be graded accordingly.

Overall, these seem very well conceived and will definitely challenge students and provide them with both fundamental process-level understanding and valuable new tools.
Thank you, Dr. Mladenov, for these comments.

Dr. Matthew Kirk

I think these both look like excellent courses. I like the topics and structure.
Nothing to note in this part.

My only concern is that you might be packing too much in there. In my opinion, it is best to give students some extra space to practice concepts before moving forward and some students will require more time to digest ideas than others. However, if we throw too much at students, they will generally retain less. As such, I prefer to go deeper on fewer topics.

I agree and I think this comment provides a valuable insight for how to run this course. In the syllabus I have described the topics in broader terms, while executing those, I will ensure to focus on individual problems that students can practice, gain and retain more knowledge.

You have probably already seen this, but just in case, there are some good lessons already developed on the GWB website: <https://academy.gwb.com/academy.php>. Harvesting those can help make your life a bit easier.

I agree and this resource has been added to the syllabus.



SCENE Office <office_scene@iitmandi.ac.in>

Fwd: regarding next semester courses and approvals in the coming BoA

Sandip Kumar Saha <sandip_saha@iitmandi.ac.in>

Fri, Oct 4, 2024 at 3:09 PM

To: SCENE Office <office_scene@iitmandi.ac.in>

Cc: Harshad Kulkarni <harshad@iitmandi.ac.in>

Dear Mamta,

Could you please check if the following course is approved by the BoA? As per the list from the academic section, available with me, this course is not approved. If it is not in your record, please include it on the BoA agenda.

Course number : CE 520

Course Name : Environmental Reaction Modeling

Dr Harshad had already communicated this course to the Chairperson. Just forwarding it for your reference and including it in the proposed BoA agenda.

Thanks and regards,
Sandip.

----- Forwarded message -----

From: **Harshad Vijay Kulkarni** <harshad@iitmandi.ac.in>

Date: Fri, Oct 4, 2024 at 3:05 PM

Subject: Fwd: regarding next semester courses and approvals in the coming BoA

To: Sandip Kumar Saha <sandip_saha@iitmandi.ac.in>

This is the document and email I sent earlier. For your reference.

Thank you,

--

Harshad Vijay Kulkarni, Ph.D.

Assistant Professor,

School of Civil and Environmental Engineering,

Indian Institute of Technology Mandi, Himachal Pradesh, India.

Office: A11-5-29, North Campus

Website: <https://sites.google.com/iitmandi.ac.in/aecbl>

----- Forwarded message -----

From: **Harshad Vijay Kulkarni** <harshad@iitmandi.ac.in>

Date: Mon, Sep 30, 2024 at 9:54 AM

Subject: Re: regarding next semester courses and approvals in the coming BoA

To: Chairperson SCENE <chair_scene@iitmandi.ac.in>

Dear Dr. Rajneesh,

I had submitted CE519 and CE520 courses for BoA approval in the last semester, but I did not see CE520 in the list of approved courses that was shared by Mamta earlier. The external reviews for the course syllabus have already been completed, and the course was taught once with one time approval. I would like to get this course approved in BoA so it can be offered in upcoming semesters. I am attaching the detailed document for your reference. Please consider this course for presenting in BoA for approval. Please let me know if any other information is required.

Thank you,

--

Harshad Vijay Kulkarni, Ph.D.

Assistant Professor,

School of Civil and Environmental Engineering,

Indian Institute of Technology Mandi, Himachal Pradesh, India.

Office: A11-5-29, North Campus

Website: <https://sites.google.com/iitmandi.ac.in/aecbl>

On Fri, Sep 27, 2024 at 9:59 AM Sandip Kumar Saha <sandip_saha@iitmandi.ac.in> wrote:

[Quoted text hidden]

--

.....
Dr. Sandip Kumar Saha

Associate Professor,

School of Civil and Environmental Engineering,

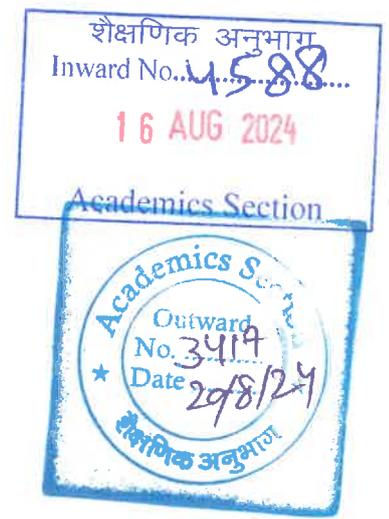
Indian Institute of Technology Mandi (IIT Mandi),

[Quoted text hidden]



Kulkarni_CE520 (2).docx
27K





IIT Mandi **Proposal for a New Course**

Course number : CE 525
Course Name : Advance Transportation Engineering
Credit Distribution : 3-0-1-4
Intended for : B.Tech (final year); MS (Research); PhD
Prerequisite : NA
Mutual Exclusion : None

1. Preamble:

Embark on a journey into the forefront of Advanced Transportation Engineering with this comprehensive course. Spanning 42 hours of theoretical exploration and 28 hours of hands-on labs, delve deeply into Pavement Materials and Design, Advanced Concrete Technologies, Highway Design, and Subgrade Interactions. Discover the intricacies of high-performance materials, geometric design standards, and sustainable pavement practices. Through practical sessions, master testing methodologies, design simulations, and innovative applications shaping the future of transportation infrastructure. Join us in advancing your expertise and preparing to tackle the complex challenges of modern transportation engineering with confidence and proficiency

2. Course Modules with quantitative lecture hours:

Unit/Topic 1: Section 1: Pavement Materials and Design

Module I: Pavement Materials: Mechanical characteristics for the pavement materials for design sections. Deformation characteristics of unbound layers (CBR, resilient modulus, modulus of subgrade reaction), functional properties (permeability) etc. [4 hrs]

Module II: Design of bituminous & Concrete mixes: Requirement of bitumen mixes, design of bituminous mixes as per Marshall Stability & flow method, parametric evaluation of bituminous mixes, IRC & MoRTH recommendations for the design mix of various layers of flexible pavements. [IRC 44] [6 hrs]

Module III: Design of Flexible Pavements: Stresses in flexible pavements, theories of stress distribution, Boussinesq's Elastic theory, Burmister's theory, considerations for flexible pavement design, IRC method & other countries method for the design of flexible pavements, AASHTO method of Pavement design [IRC: 37 2018] [8 hrs]

Module IV: Design of Rigid Pavements: Stresses in rigid pavements, Westergaard method of rigid pavement design, IRC method of rigid pavement design for plain dowel jointed slabs, design of joints and load transfer devices; design of tie bars, joint fillers and sealers, design of continuously reinforced concrete pavements, design of thin & ultra-thin white toppings as overlay. [IRC 58:2015] [8 hrs]

Unit/Topic 2: Section 2: Highway Planning and Design

- **Traffic Planning & control:** Fundamental principles of Traffic Flow, Traffic flow Elements, Flow Density Relationships, Traffic signs, Road markings, traffic signals, type's i.e. simultaneous system, alternate system, simple progressive system and flexible progressive system, general principles of signal design, Roadway delineations, object markers, guard rails, Barriers. **[6 hrs]**
- **Highway capacity & Intersection design:** PCU, Level of service concepts, factors affecting capacity, capacity of urban highways, capacity of rotary intersection, Design of intersection, grade separated intersection, Need for rotary intersection, principles of design, design of rotary intersection. **[6 hrs]**
- **Lab Sessions (8 hours)**
 - Testing and Characterization of Pavement Materials
 - Laboratory Work: 1. Plate bearing test. 2. Stability and Flow value test of bituminous mix as per Marshall Criteria. 3. Evaluation of pavement by Benkelman beam. 4. Evaluation of pavement roughness by Bump Integrator. 5. Introduction to highway engineering softwares(HEADS, MX Road and HDM4) 6. To conduct Pavement Deterioration tests.
 - Design and Analysis of Pavement

3. Text books:

1. Khanna S.K. and C.E.G. Justo, "Highway Engineering", Nemchand Bros, (2002) 2.
2. Kadyali L. R.; Highway Engineering, Nem Chand & Brothers, Roorkee(2002)

References:

1. Sharma & Sharma; Principle and Practice of Highway Engineering, Asia Publishing House, New Delhi (1980).
2. Road Development plan for India (1981-2001), IRC, New Delhi, (1984).
3. Rao G. V.; Transportation Engineering, Tata McGraw Hill Publisher, New Delhi
4. Highway Materials, H.M.S.O.(London).
5. Yoder E. J.; Principles of Pavement Design, John Wiley & Sons, (October 1975)
6. Haas R.C.G. , Hudson W. Ronald., Zaniewski John P., Modern Pavement Management, Krieger Publishing Company, 1994.
7. Susan Brown, Pavement Management Systems, Transportation Research Board, 1993.

(No limit on numbers, relevant standard format can be followed, the formats should be similar)

4. Similarity with the existing courses:

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.		Course Code	Similarity Content	Approx. % of Content
1.			8%	

6. Justification of new course proposal if cumulative similarity content is >30%:

None

Approvals:

Other Faculty interested in teaching this course: – NA

Proposed by: Dr. Surya Kant Sahdeo

School: SCENE

Signature: SKS

Date: 16/08/24

Recommended/Not Recommended, with Comments:

Recommended
21/21/21/21
Chairperson, CPC

Date: 16/08/24

Approved / Not Approved

Chairperson, BoA

Date: _____

Indian
Institute of
Technology
Mandi



Praveen Kumar

to me ▾

Tue, Aug 6, 6:21 PM (8 days ago)



Dear Dr Surya Kant

It is a good combination of Pavement Materials, Design and Traffic Engg. I believe it will be useful for the students. It may be floated as such.
Best wishes

Prof Praveen Kumar

Head, Civil Engineering Department

(Ex-Director, NIT Delhi)

MoRTH Chair Professor

Transportation Engineering Group

Department of Civil Engineering

Indian Institute of Technology (IIT)

Roorkee-247667 (Uttarakhand)

Phone 01332-285470, 285219 (O)

01332-285616 (R)

Mobile 9412307245

Alternative email praveenaeron@gmail.com, head@ce.iitr.ac.in

Member, Board of Governors, IIT-BHU

Coordinator, Principal Technical Agency, PMGSY

National Coordinator for Rural Infrastructure under Unnat Bharat Abhiyan

Visitor's Nominee for IIT Bhubaneshwar, IIT Hyderabad and All NITs

Formerly

Visitor Nominee for IITD, IITM, IITJ and BHU

Associate Dean, IIT Roorkee



Surender Singh IITM surender@civil.iitm.ac.in

Aug 6, 2024, 5:52 PM (8 days ago)



To me: [surender_sde@bharma](#)

Dear Prof. Surya Kant: Thank you for approaching me for feedback on the proposed course. I have the following suggestions and comments:

1. It seems the course is 5000 level and therefore, some of the things could be avoided assuming these will be taught at the undergraduate level. For example, in module 1, you may remove the introduction to soil/aggregate/cement/bitumen part and instead focus on the mechanical characteristics for the pavement design sections (modules 3 and 4). You may include the following: deformation characteristics of unbound layers (CBR, resilient modulus, modulus of subgrade reaction), functional properties (permeability) etc. For aggregates, you may have 1-2 classes on sampling and physical and mechanical characterization (specific gravity type etc). You may cover VG and PG grading of bitumen here. Cement hydration and its impact on joints and shrinkage can be discussed.
2. Module 2: It seems it is heavily focused on bituminous materials and the cement concrete portion is not considered much. You may think of including fresh (compaction factor, plastic shrinkage), mechanical (modulus of rupture, compressive strength, abrasion resistance) etc properties. Also, you may discuss the design of RCCP/DLC as these are used for base-layer applications.
3. It might be difficult to cover these many things in 8 hours. You may touch upon AASHTO and pay more focus on layered-elastic theory and its application in designing Indian roads as per IRC.
4. I am not an expert on Module 5 and Module 6 and therefore, it will be better to get comments from a domain expert.

Regards

Surender



IIT Mandi

Proposal for a New Course

Course number : CE526
Course Name : **Critical Zone Science**
Credit Distribution : 2-1-0-3
Intended for : PG and Ph.D. students
Prerequisite : None
Mutual Exclusion : None

1. Preamble:

This comprehensive course explores the intricacies of the critical zone, a vital layer extending from treetops to bedrock that sustains terrestrial life. Students will master fundamental concepts, cutting-edge research methods, land-atmosphere interactions, and water transfer processes within this crucial ecosystem. The curriculum offers hands-on experience in designing observatories, collecting and analyzing data, and unraveling the complex interplay of energy, carbon, and water cycles. Bridging theory and practice, this course prepares students for advanced research and professional roles in hydrology, soil science, ecology, and environmental management. A key feature is the inclusion of 14 hours of detailed tutorials, providing in-depth, practical application of critical zone theories and modeling techniques.

2. Course Modules with quantitative lecture hours:

- | | |
|--|----------------|
| <p>Module I: Introduction to critical zone science
 Definition of critical zone and its components, critical zone observatory; Role of soil in critical zone; Introduction to system modelling; Critical zone architecture and evolution</p> | <p>6 Hours</p> |
| <p>Module II: Methods in critical zone science
 Design of a critical zone observatory; Tool and techniques for critical zone datasets: Land-atmosphere data, vegetation and associated microbiota, soil (vadose zone), saprolite and bedrock (saturated zone), surface water; Analysis of event-based and continuous fluxes across critical zone interfaces; Pre-processing and analysis of various fluxes using data analysis and statistical computing.</p> | <p>6 Hours</p> |
| <p>Module III: Land-atmosphere exchange in critical zone
 Energy budget, earth-atmosphere energy, types of energy transfers, energy balance at earth's surface, effective energy and mass transfer; Carbon budget, carbon cycle and components, global carbon cycle; carbon allocations, controls of Net Primary Production (NPP), carbon relationships</p> | <p>4 hours</p> |

Module IV: Water transfer through the critical zone

6 Hours

Introduction to various runoff generation mechanisms, Dunne diagram; Quantify or track the hydrological cycle in the field; Water balance closure analysis across various temporal and spatial scales; Simulation of runoff generation in hydrologic models;

Water balance of a Tree; Water balance impacts, analyze the impact of forest fire and drought on water cycle and nutrient fluxes; Humans in the critical zone; Simulation of water, carbon, energy, and nutrient fluxes

6 Hours

3. Text books:

- 1) Giardino, J. R., & Houser, C. (2015). Principles and dynamics of the critical zone. Elsevier.
- 2) Beven, K. J. (2011). Rainfall-runoff modelling: the primer. John Wiley & Sons.
- 3) Dingman, S. L. (2015). Physical hydrology. Waveland press.

4. References:

- 1) Tarboton, D. G. (2003). Rainfall-runoff processes.
- 2) Banwart, S. A., Nikolaidis, N. P., Zhu, Y. G., Peacock, C. L., & Sparks, D. L. (2019). Soil functions: connecting earth's critical zone. Annual Review of Earth and Planetary Sciences, 47(1), 333-359.
- 3) Relevant research papers will be provided during class.

5. Similarity with the existing courses: None

(Similarity content is declared as per the number of lecture hours on similar topics)

6. Justification of new course proposal if cumulative similarity content is: NA

Other Faculty interested in teaching this course: –

1. Dr. Dericks P Shukla
2. Dr. Vivek Gupta

Proposed by: Dr. Aliva Nanda

School: SCENE

Signature:



Date: 4/10/2024

Recommended/Not Recommended, with Comments:

रजनीशशर्मा 07/10/24

Date: _____

Chairperson, CPC

Approved / Not Approved

Date: _____

Chairperson, BoA

The following external faculty (at least 2 faculty) provided the feedback, and it was discussed among school/centre faculty on.....

Sl. No	Faculty Name	Signature
1.	Prof. Sushil Kumar Himanshu	J Email approval attached
2.	Prof. Priyank J. Sharma	
3.	Prof. Abhishek N. Srivastava	

School Chair:

School:

Date:

This proposal is reported inth Board of Academics on

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Comments and detailed reply to the Reviewers:

Prof. Sushil Himanshu:

Thank you for your email and invitation to review the course proposal. The proposal seems very good to me. I have provided some minor suggestions (as comments) that you may want to consider.

Reply: Thank you for your detailed comments. I incorporated the comments.

1. Not sure, Is there any Prerequisites for this course?

Reply: As this is a PG and PhD level course for civil engineering, I believe that students already have experience in hydrology/water resources engineering-related courses during their bachelor's degree.

2. I suggest adding a topic related to 'How climate change affects Critical Zone processes' and 'Critical Zone response to extreme events'.

Reply: In module IV, "Impact of forest fire and drought on water cycle and nutrient flux" is there.

3. Why only the role of soil? I think role of hydrology, atmosphere, vegetation, etc. should also be introduced.

Reply: Thank you for the question. The detailed about role of hydrology and vegetation is there in module IV.

4. Can we write as 'using data analysis and statistical computing'.

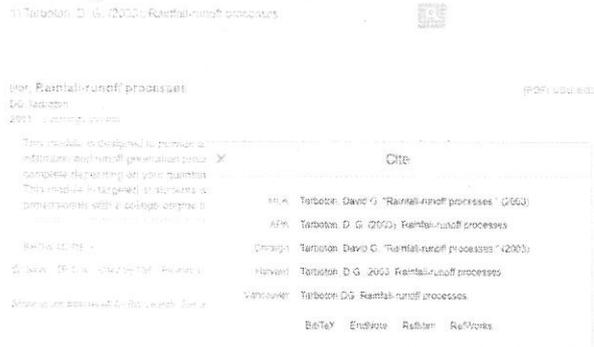
Reply: incorporated

5. Is it part of module IV or a separate module?

Reply: It is part of module IV

6. Please check and include full reference.

Reply: I double-checked it in Google Scholar. The reference is correct. Added the screen short for you to look over.



7. I suppose this is a book series. Please add editors. Please, use consistent format for all references.

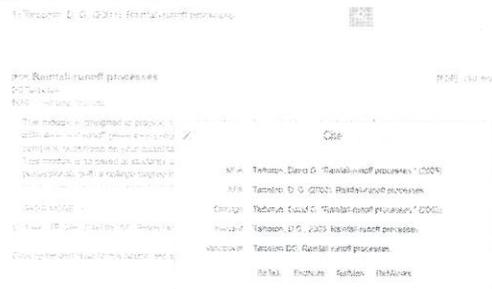
Reply: Incorporated. "Giardino, J. R., & Houser, C. (2015). *Principles and dynamics of the critical zone*. Elsevier."

Prof. Priyank Sharma:

I have thoroughly reviewed the proposed course and appreciate your efforts in crafting this unique course-of-its-kind.

The course is well-designed and technically balanced. I do not see any technical modification in the course content. However, the reference of Tarboton, D. G. (2003) seems incomplete, which may be corrected.

Reply: Thank you so much for the constructive comments. I double-checked the reference, and it looks fine.



Prof. Abhishek N Srivastava:

I have reviewed the content of the proposed course "Critical Zone Science". The overall module structure looks interesting, comprehensive and very well designed including wide coverage of Fundamentals of critical zone science to its application based concepts. I feel that the proposed course would be really helpful for PG and PhD students interested to explore research areas of Environment, Climate and Water Resources, Geosciences and even Ecological aspects.

Reply: Thank you for your detailed comments and suggestions. I have incorporated comments in the proposal.

1. Inclusion of taxonomy target levels (Apply, Analyze, Evaluate, etc.) of course content may be done in the preamble, which might be attractive for course beneficiaries.

Reply: Thank you for your suggestions. I have included this terminology wherever necessary, especially in modules II and IV.

2. Since modeling and simulation techniques seem to cover the majority of content from Module II to IV, if any software (or tools) are planned to be taught for hands-on experience to students, the name of software can be exclusively mentioned. This may provide fascination to students to learn the software which they can probably utilize for their research works.

Reply: Thank you for the suggestions. I plan to teach the TOPMODEL and RHESys models in the first year. However, I will continue to update the curriculum with different modeling tools in subsequent years. For this reason, I have not specified any particular model names in the module description to avoid restricting the teaching scope.

3. Some more (1-2) relevant textbooks may be suggested with ISBN numbers and Edition No. to make book search precise and convenient.

Reply: As this is a multidisciplinary course, relevant research papers will be provided to scholars during classes.





Aliva Nanda <aliva@iitmandi.ac.in>

Request to Review a Course Proposal

Dr. Sushil Kumar Himanshu <sushil-kumar@ait.asia>
To: Aliva Nanda <aliva@iitmandi.ac.in>

Thu, Oct 3, 2024 at 2:55 PM

Dear Dr. Aliva,

Thank you for your email and invitation to review the course proposal. The proposal seems very good to me. I have provided some minor suggestions (as comments) that you may want to consider.

Best regards,
Sushil

On Sun, Sep 29, 2024 at 9:58 AM Aliva Nanda <aliva@iitmandi.ac.in> wrote:

Dear Prof. Himanshu,

Good morning!

I hope you are doing well.

I am proposing a new course named "Critical Zone Science" for PG and PhD students in the School of Civil and Environmental Engineering, IIT Mandi. I have attached the course proposal for your review.

The next Board of Academic (BOA) meeting is scheduled for October 10, 2024. Given this timeline, I would greatly appreciate it if you could provide your review at your earliest convenience.

Thanks, and Regards
Aliva

--

Aliva Nanda, PhD
Assistant Professor,
School of Civil and Environmental Engineering, IIT Mandi
Office location: A11, 5th floor, Room No: 42
E Mail : aliva.rkl2010@gmail.com / aliva@iitmandi.ac.in

 **New_course_proposal_critical_zone_science.pdf**
166K



Aliva Nanda <aliva@iitmandi.ac.in>

Request to Review a Course Proposal

Dr. Priyank Sharma <priyanksharma@iiti.ac.in>
To: Aliva Nanda <aliva@iitmandi.ac.in>

Thu, Oct 3, 2024 at 4:39 PM

Dear Prof. Aliva,

I have thoroughly reviewed the proposed course and appreciate your efforts in crafting this unique course-of-its-kind. The course is well-designed and technically balanced. I do not see any technical modification in the course content. However, the reference of Tarboton, D. G. (2003) seems incomplete, which may be corrected.

I am sure this course will interest the students, and they will greatly benefit from it.

Thanks and Regards!
Priyank Sharma

On Sun, Sep 29, 2024 at 8:20 AM Aliva Nanda <aliva@iitmandi.ac.in> wrote:
Dear Prof. Sharma,

Good morning!

I hope you are doing well.

I am proposing a new course named "Critical Zone Science" for PG and PhD students in the School of Civil and Environmental Engineering, IIT Mandi. I have attached the course proposal for your review.

The next Board of Academic (BOA) meeting is scheduled for October 10, 2024. Given this timeline, I would greatly appreciate it if you could provide your review at your earliest convenience.

Thanks, and Regards
Aliva

--

Aliva Nanda, PhD
Assistant Professor,
School of Civil and Environmental Engineering, IIT Mandi
Office location: A11, 5th floor, Room No: 42
E Mail : aliva.rkl2010@gmail.com / aliva@iitmandi.ac.in



Aliva Nanda <aliva@iitmandi.ac.in>

Request to Review a Course Proposal

Abhishek N Srivastava <abhishekns@nitc.ac.in>
To: Aliva Nanda <aliva@iitmandi.ac.in>

Thu, Oct 3, 2024 at 9:39 PM

Dear Dr. Aliva,

Thanks for reaching me out.

I have reviewed the content of the proposed course "**Critical Zone Science**". The overall module structure looks interesting, comprehensive and very well designed including wide coverage of Fundamentals of critical zone science to its application based concepts. I feel that the proposed course would be really helpful for PG and PhD students interested to explore research areas of Environment, Climate and Water Resources, Geosciences and even Ecological aspects.

However, I suggest following points that can be incorporated, if possible, based on the IIT Mandi's academic curriculum rules:-

1. Inclusion of taxonomy target levels (Apply, Analyze, Evaluate, etc.) of course content may be done in the preamble, which might be attractive for course beneficiaries.
2. Since modeling and simulation techniques seem to cover the majority of content from Module II to IV, if any software (or tools) are planned to be taught for hands-on experience to students, the name of software can be exclusively mentioned. This may provide fascination to students to learn the software which they can probably utilize for their research works.
3. Some more (1-2) relevant textbooks may be suggested with ISBN numbers and Edition No. to make book search precise and convenient.

I am sure that this course would be a great success and an asset to the curriculum of IIT Mandi.

Best Wishes!

Best Regards,

Dr. Abhishek N Srivastava
Assistant Professor
Department of Civil Engineering
National Institute of Technology (NIT) Calicut
Kozhikode, Kerala
India - 673601
Tel:- +91- 7002728686
Homepage: [visit here](#)

On Thu, Oct 3, 2024 at 6:07 PM Aliva Nanda <aliva@iitmandi.ac.in> wrote:

Dear Prof. Abhishek,

I hope you are doing well.

I am proposing a new course named "Critical Zone Science" for PG and PhD students in the School of Civil and Environmental Engineering, IIT Mandi. I have attached the course proposal for your review.

The next Board of Academic (BOA) meeting is scheduled for October 10, 2024. Given this timeline, I would greatly appreciate it if you could provide your review at your earliest convenience.

Thanks, and Regards
Aliva

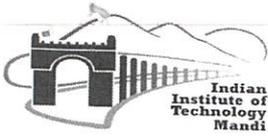
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Aliva Nanda, PhD

10/4/24, 12:13 AM

Educational Mail - Request to Review a Course Proposal

Assistant Professor,
School of Civil and Environmental Engineering, IIT Mandi
Office location: A11, 5th floor, Room No: 42
E Mail : aliva.rkl2010@gmail.com / aliva@iitmandi.ac.in



SCENE Office <office_scene@iitmandi.ac.in>

New course proposal submission

16 messages

Aliva Nanda <aliva@iitmandi.ac.in>

Fri, Oct 4, 2024 at 1:20 AM

To: Chairperson SCENE <chair_scene@iitmandi.ac.in>

Cc: Mamta <office_scene@iitmandi.ac.in>, Sandip Kumar Saha <sandip_saha@iitmandi.ac.in>

Dear Prof. Sharma,

I am proposing a new course titled "Critical Zone Science" and have prepared a course proposal accordingly. As per the guidelines, I have had the proposal reviewed by three external experts. I have attached all the email trails for your reference.

I have incorporated all the reviewers' comments into the proposal. Please find the revised course proposal attached for your consideration.

Kindly do the needful.

Please let me know if you have any questions regarding the same.

Best regards,

Aliva

--

Aliva Nanda, PhD
Assistant Professor,
School of Civil and Environmental Engineering, IIT Mandi
Office location: A11, 5th floor, Room No: 42
E Mail : aliva.rkl2010@gmail.com / aliva@iitmandi.ac.in

 **Critical_zone_science.zip**
799K

Chairperson SCENE <chair_scene@iitmandi.ac.in>

Fri, Oct 4, 2024 at 11:09 AM

To: Aliva Nanda <aliva@iitmandi.ac.in>, Mamta <office_scene@iitmandi.ac.in>, Sandip Kumar Saha <sandip_saha@iitmandi.ac.in>, R Prasanna <prasanna@iitmandi.ac.in>, Deepak Swami <deepak@iitmandi.ac.in>

Dear Dr Aliva

Dr Sandeep and Dr Prasana are looking after the development of the courses, so you can contact them. Before doing this, kindly also take the consent and comments from the theme coordinator Dr. Deepak.

Thanks and Regards**धन्यवाद एवं शुभकामनाएँ**-----
HK**Dr. Rajneesh Sharma**

Chair and Associate Professor,
School of Civil and Environmental Engineering,
IIT Mandi, North Campus, Kamand,
Mandi, 175075, HP.

[Quoted text hidden]

Aliva Nanda <aliva@iitmandi.ac.in>

Fri, Oct 4, 2024 at 11:22 AM

R Prasanna <prasanna@iitmandi.ac.in>

Fri, Oct 4, 2024 at 11:43 AM

To: Chairperson SCENE <chair_scene@iitmandi.ac.in>

Cc: Aliva Nanda <aliva@iitmandi.ac.in>, Mamta <office_scene@iitmandi.ac.in>, Sandip Kumar Saha <sandip_saha@iitmandi.ac.in>, Deepak Swami <deepak@iitmandi.ac.in>

Hello all,

The course has already been reviewed by external experts.

@Deepak Swami , as the theme coordinator, please let me know if you are ok with this new course proposal.

@SCENE Office , after Dr. Deepak's comments, please assign a course number and add it to the agenda for the upcoming BoA meeting.

Thanks and Regards,
Prasanna.

On Fri, Oct 4, 2024 at 11:09 AM Chairperson SCENE <chair_scene@iitmandi.ac.in> wrote:

[Quoted text hidden]

Aliva Nanda <aliva@iitmandi.ac.in>

Sat, Oct 5, 2024 at 12:19 PM

To: R Prasanna <prasanna@iitmandi.ac.in>, Deepak Swami <deepak@iitmandi.ac.in>

Cc: Chairperson SCENE <chair_scene@iitmandi.ac.in>, Mamta <office_scene@iitmandi.ac.in>, Sandip Kumar Saha <sandip_saha@iitmandi.ac.in>

Dear Dr. Swami,

Could you please provide your comments if you have any?

Kindly do it as earliest as your convenience as the BoA agenda need to be finalized by 6th Oct.

Looking forward to your kind and timely cooperation.

Best,
Aliva

[Quoted text hidden]

Deepak Swami <deepak@iitmandi.ac.in>

Sat, Oct 5, 2024 at 2:52 PM

To: Aliva Nanda <aliva@iitmandi.ac.in>

Cc: R Prasanna <prasanna@iitmandi.ac.in>, Chairperson SCENE <chair_scene@iitmandi.ac.in>, Mamta <office_scene@iitmandi.ac.in>, Sandip Kumar Saha <sandip_saha@iitmandi.ac.in>

Dear Dr. Aliva,

I have reviewed the proposal, can you please clarify about the space requirement and other resources you will be requiring to efficiently organize the course and learning outcome.

Thanks

[Quoted text hidden]

Aliva Nanda <aliva@iitmandi.ac.in>

Sat, Oct 5, 2024 at 4:34 PM

To: Deepak Swami <deepak@iitmandi.ac.in>

Cc: R Prasanna <prasanna@iitmandi.ac.in>, Chairperson SCENE <chair_scene@iitmandi.ac.in>, Mamta <office_scene@iitmandi.ac.in>, Sandip Kumar Saha <sandip_saha@iitmandi.ac.in>

Dear Dr. Swami,

Thank you for your reply.

This is a theoretical course with tutorial hours. This course can be organised in any class room or in our conference room. For the modelling and coding purpose, students can use their laptops.

The course will introduce students to handling primary eco-hydrological datasets, including rainfall, discharge, and sap flow data. To enhance research skills, students will learn essential techniques for processing and cleaning field data.

Moreover, this course is designed to provide a comprehensive understanding to our students starting from field study to modelling approach. This proposed course is timely as it will give an idea about various Hydrological and eco-

Dr. Sandip Kumar Saha
Associate Professor,
School of Civil and Environmental Engineering,
Indian Institute of Technology Mandi (IIT Mandi),
Kamand Campus, VPO Kamand,
Mandi, Himachal Pradesh,
PIN – 175075, India.

Phone: +91-1905-267-907

<https://sites.google.com/site/sandipksh/home?authuser=0>

http://faculty.iitmandi.ac.in/~sandip_saha/

https://scene.iitmandi.ac.in/pages/postdocs_details/Nw==

Preeti Rana <office_sceneoa1@iitmandi.ac.in>

Mon, Oct 7, 2024 at 10:11 AM

To: Chairperson SCENE <chair_scene@iitmandi.ac.in>

Cc: Sandip Kumar Saha <sandip_saha@iitmandi.ac.in>, R Prasanna <prasanna@iitmandi.ac.in>, Mamta <office_scene@iitmandi.ac.in>

Dear All,

As requested, the time schedule for the meeting is as follows:

Time: 1:00-1:30 P.M (Today)

With Warm Regards,

प्रीति राणा / Preeti Rana

कार्यालय सहायक / Office Assistant

सिविल एवं पर्यावरण अभियांत्रिकी स्कूल / School of Civil & Environmental Engineering

भारतीय प्रौद्योगिकी संस्थान / Indian Institute of Technology, Mandi (H.P)

[Quoted text hidden]

Sandip Kumar Saha <sandip_saha@iitmandi.ac.in>

Mon, Oct 7, 2024 at 12:46 PM

To: Preeti Rana <office_sceneoa1@iitmandi.ac.in>

Cc: Chairperson SCENE <chair_scene@iitmandi.ac.in>, R Prasanna <prasanna@iitmandi.ac.in>, Mamta <office_scene@iitmandi.ac.in>

Dear Preeti,

Please let me know the venue for the meeting?

Thanks & Regards,
Sandip.

[Quoted text hidden]

Preeti Rana <office_sceneoa1@iitmandi.ac.in>

Mon, Oct 7, 2024 at 12:48 PM

To: Sandip Kumar Saha <sandip_saha@iitmandi.ac.in>

Cc: Chairperson SCENE <chair_scene@iitmandi.ac.in>, R Prasanna <prasanna@iitmandi.ac.in>, Mamta <office_scene@iitmandi.ac.in>

Dear Sir,

The venue is the Chair office.

With Warm Regards,

प्रीति राणा / Preeti Rana

कार्यालय सहायक / Office Assistant

सिविल एवं पर्यावरण अभियांत्रिकी स्कूल / School of Civil & Environmental Engineering

भारतीय प्रौद्योगिकी संस्थान / Indian Institute of Technology, Mandi (H.P)

[Quoted text hidden]

Aliva Nanda <aliva@iitmandi.ac.in>

Tue, Oct 8, 2024 at 3:22 PM

To: scene@iitmandi.ac.in

Cc: Chairperson SCENE <chair_scene@iitmandi.ac.in>, Mamta <office_scene@iitmandi.ac.in>, Sandip Kumar Saha <sandip_saha@iitmandi.ac.in>, R Prasanna <prasanna@iitmandi.ac.in>

Dear All,

Please find the new course proposal titled 'Critical Zone Science'. This proposal has been evaluated by three external reviewers and approved by the Water Resource theme coordinator, Prof. Deepak Swami.

Please let me know if you have any feedback or suggestions.

Best,
Aliva

On Sat, Oct 5, 2024 at 9:54 PM Deepak Swami <deepak@iitmandi.ac.in> wrote:

Since there are no additional space or fund requirement, please go ahead.

If in future need arises, I suggest to discuss well in advance.

Regards

[Quoted text hidden]

[Quoted text hidden]



Critical_zone_science.zip

799K



IIT Mandi

Proposal for a New Course

Course number	: CE 527
Course Name	: Advanced Pavement Engineering
Credit Distribution	: 3-0-2-4
Intended for	: UG; PG
Prerequisite	: On approval of the course instructor.
Mutual Exclusion	: None

1. Preamble:

This course provides a comprehensive study of both concrete and bituminous pavement technologies. It consists of 42 hours of lectures and 28 hours of lab work. Students will explore the chemical and physical properties of pavement materials, including cement, bitumen and admixtures, as well as their performance in various pavement systems. The course covers key aspects of pavement design, including modern empirical methods, material characterization, and the role of factors such as traffic, climate, and subgrade conditions. In addition to design principles, students will learn about advanced evaluation techniques for assessing pavement conditions and explore recent trends in sustainable pavement technologies. The lab sessions will provide practical experience, reinforcing the theoretical knowledge gained in lectures.

2. Course Modules with quantitative lecture hours:

Module 1: Cement and Concrete Pavement Technology (18 hours)

Cement and Concrete Pavement Technology: Cement Production and Cement Chemistry, Effect of mineral and chemical admixtures (including grinding aids). Supplementary cementitious materials and its effect on hydration Properties of hydrated Portland cement Fresh paste structure and properties; Concrete Pavement Fundamentals: Concrete pavement types, Elements (typical) of concrete pavement types, evolution of concrete pavement design, types of loads on concrete pavements, typical response of concrete pavements to load, typical distresses in concrete pavements. (12 hours)

Pavement Design Methods- Empirical approaches to the design of concrete pavement, Mechanistic - Empirical approaches to design of concrete pavements, Portland Cement Association, IRC:58-2015, Function of joints, Types of joints, Dowel bars vs tie bars. (6 hours)

Module 2: Bituminous Technology and Analysis & Design of Flexible Pavement (11 hours)

Bituminous Technology: Physical and chemical characterization of bitumen. Aging of bitumen, Binder properties and their relationship to pavement performance. Modification of bitumen, modified binders such as polymers and rubbers. (6 hours)

Analysis & Design of Flexible Pavement: Stresses and Deflections in Homogeneous Masses Elastic Layer Theories - Wheel Load Stresses – VDF. IRC 37: 2018 (5 hours)

Module 3: Pavements Maintenance and Evaluation (8 hours)

Pavement Surface Condition & Its Evaluation: Various Aspects of Surface and their Importance; Skid resistance, Pavement Condition Index (PCI), International Roughness Index (IRI), Causes, Factors Affecting, Measurement of skid resistance, Pavement functional and structural evaluation and its importance. (4 hours)

Pavement Overlays & Design: Pavement Overlays, Design of Flexible Overlay over Flexible Pavement by Benkelman Beam Deflection and other Methods, Flexible Overlays and Rigid Overlays over Rigid Pavements, Use of Geosynthetics in Pavement Overlays. (4 hours)

Module 4: Recent trends in Pavement Technology (5 Hours)

Guidelines and practices – Cold mix technologies and warm mix technologies: materials, additives, guidelines and practices. Perpetual Pavement, White topping, roller compacted concrete pavements, interlocking paving blocks, pervious concrete pavements, precast concrete pavements for highways and airfield; industrial pavements; concrete pavements for low volume road. (5 Hours)

Laboratory Experiments: (Total no of tests: 10)

1. Pavement Materials Testing,
2. Bitumen Content of RAP,
3. Rotational Viscometer Test,
4. Evaluates the viscoelastic properties of bitumen binder under different stress and temperature conditions,
5. Aging Tests on bitumen,
6. Rapid Chloride Penetration Test (RCPT),
7. Benkelman Beam Deflection test,
8. Heat of Hydration test,
9. Compressive strength test for cube test specimens
10. Flexural strength tests for beam samples

3. Textbooks:

1. Cement Chemistry, H.F.W. Taylor, 2nd Edition, Thomas Telford, 1997
2. Yang H. Huang, Pavement Analysis and Design, 2nd Edition, Pearson, 2004

4. References:

1. Shaw, D. J. *Introduction to Colloid and Surface Chemistry*. 4th ed., Butterworth, 1992.
2. Hewlett, P. C. *Chemistry of Cement and Concrete*. 4th ed., Elsevier Science & Technology Books, 2004.
3. Delatte, N. *Concrete Pavement: Design, Construction and Performance*. Taylor & Francis, 2008.
4. Riveiro, B., and M. Solla. *Non-Destructive Techniques for the Evaluation of Structures and Infrastructure*. CRC Press, 2016.
5. Odler, I. *Special Inorganic Cements*. E&FN Spon (Taylor & Francis Group), 2000.
6. *Relevant AASHTO Guidelines; Relevant ASTM Testing and Methodologies*.

5. Similarity with the existing courses:

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Course Name	Course Code	Approx. % of Content	Similarity content
1.	Transportation Engineering	CE 352	IRC 37: 2018 basic	3%
2.	Civil Engineering Materials	CE 203	Cement Concrete and Asphalt	5%
3.	Transportation Engineering Laboratory	CE 352P	Aggregate testing, BBD tests	3%

6. Justification of new course proposal if cumulative similarity content is >30%: N.A
Approvals:

Other Faculty interested in teaching this course: – NA

Proposed by: Dr. Surya Kant Sahdeo

School: SCENE

Signature:



Date: 29/09/2024

Recommended/Not Recommended, with Comments

Date : _____ Date: _____

Chairperson, CPC

Approved / Not Approved

Date: _____ Date: _____

Chairperson, BoA

The following **external** faculty (at least 2 faculty) provided the feedback, and it was discussed among school/centre faculty on : Email attached

Sl. No	Faculty Name
1	Prof. Praveen Aeron, Head of Department, Civil Engineering, IIT Roorkee
2	Prof. G.D Ransinchung R.N, IIT Roorkee

School Chair: **Dr Rajnish Sharma**

School: SCENE

Date:

This proposal is reported inth Board of Academics on

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Internal Faculty Comments:



Ashutosh Kumar

to me, scene ▾

Mon, Oct 7, 4:18 PM (1 day ago) ☆ ↶

Dear Surya,

Following points I would like to suggest:

1. For 5 Level course, I would suggest to keep some prerequisite.
2. Intended For: rather than MS and PhD, it should be for UG and PG (UG students also take 5 level course)
3. It should be within DE category.
4. In addition to the preamble, it should also have the Course Outcome.
5. In your division with Units, Here we usually divide in Module 1, 2, 3, 4,..... I am not sure. other colleagues may comment on that.
6. Main Textbooks: I would suggest to keep 2 rather than 4. The remaining can be shifted to References.
7. Please check a number of lectures hours and Tutorials hours required for 4-credit course.

Suggestions are indicative!

Regards

Ashutosh.



Kala Venkata Uday

to scene, Ashutosh, me ▾

Mon, Oct 7, 4:26 P

Dear Ashutosh

Much valid comments for the course, mainly the format

A few corrections: Pt 3 and 4 comments are not valid as the new course proposal does not look into the category and has no specific need for course outcome. The outcome can be a part of the preamble itself.

Dear Surya,

Make changes for the other sections as mentioned in the format as well. each credit needs 14 hours, so mark the duration accordingly.

Regards

Uday



Shivang Shekhar

to me ▾

Dear Surya,

Overall, the content is OK, as expert external reviewers have formally approved it.

Few suggestions:

- Instead of Unit 1, Unit 2... Write Module 1, Module 2...
- For 4 credit courses (3 Lecture Hours and 2 Lab Hours per week), the total contact hours should be - $3 \times 14 + 2 \times 14 = 42 + 28$
- Contact hours for only module/unit are required.
- Elaborate the preamble highlighting the course content and learning outcome
- Change the last heading to Laboratory Experiments
- Similarity content is written as 10%, but the course name is NA. Correct it.

Shivang



Sandip Kumar Saha

to me, scene ▾

9:40 AM (7 hours ago) ☆ ↶ ⋮

Dear Surya,

Thanks for proposing a new 5 level course which will expand our diversity in the course offering. As the content has already been reviewed by external experts, my observations are primarily related to the internal record keeping in standard format.

Please note my observations for your consideration:

1. Intended for : It should be M Tech (R) in place M S(R). Can't this course be credited by CE B Tech. students as elective? Please consider.
2. Prerequisite: It is expected to have some prerequisites for 5 level courses. Otherwise, it might be difficult to justify if any PG students, without having background of basic transportation engineering and/or pavement/construction materials, visit to opt for it.
3. Course lecture hours must add up to 42.
4. It is suggested to list out (enumerate) the experiments for 28 hours (may be 10-12 experiments of about 2hours)
5. Textbooks: It is recommended to keep at most 2 textbooks. Remaining may be part of references.
6. It is requested to include complete bibliographic details for all the textbooks and references in any standard but uniform format.
7. Similarity with the following courses may be examined with justification of advanced topics in this 5 level course. Ideally the overlap for a B Tech. student, who has credited the following courses, must be minimum and should learn advance concepts.
 - a) CE 203: Civil Engineering Materials
 - b) CE 352: Transportation Engineering
 - c) CE 352P: Transportation Engineering Laboratory

The proposal format needs to be re-checked.

The latest proposal format may be taken from the school office or access it here <https://docs.google.com/document/d/1OtrEqjIEF5rL4fGAgNyWY0FD2X9c6-/edit?pli=1>.

Thanks and regards,

Sandip.

External Faculty comments :

Pavement Design Methods- Empirical approaches to the design of concrete pavement, Mechanistic - Empirical approaches to design of concrete pavements, Portland Cement Association, **IRC:58-2015, Function of joints**, Types of joints, Dowel bars vs tie bars. (4 hours)

Unit 2: Bituminous Technology and Analysis & Design of Flexible Pavement

Bituminous Technology: Physical and chemical characterization of bitumen. Aging of bitumen, Binder properties and their relationship to pavement performance. Modification of bitumen, Various manufacturing process for modified binders such as polymers and rubbers. **aggregate gradations**. (5 hours)

Analysis & Design of Flexible Pavement: Stresses and Deflections in Homogeneous Masses - Burmister's 2- layer, 3- layer Theories - Wheel Load Stresses - ESWL of Multiple Wheels - ESAL – VDF - Repeated Loads and EWL factors - Sustained Loads and Pavement behaviour under Traffic Loads Mechanistic Empirical Pavement Design – Guidelines and examples. (7 hours)

Unit 3: Pavements Maintenance and Evaluation

Pavement Surface Condition & Its Evaluation: Various Aspects of Surface and their Importance; **Skid resistance, Pavement Condition Index (PCI), International Roughness Index (IRI)**, Causes, Factors Affecting, **Mesurement of skid resistance, Pavement functional and Structural evaluation techniques and its importance**. (5 hours)

Pavement Overlays & Design: Pavement Overlays, Design of Flexible Overlay over Flexible Pavement by Benkelman Beam Deflection and other Methods, Flexible Overlays and Rigid Overlays over Rigid Pavements, Use of Geosynthetics in Pavement Overlays.

(4 hours)

Unit 4: Recent trends in Pavement Technology

Guidelines and practices – Cold mix technologies and warm mix technologies: materials, additives, guidelines and practices. Perpetual Pavement, White topping, roller compacted concrete pavements, interlocking paving blocks, pervious concrete pavements, precast concrete pavements for highways and airfield; industrial pavements; concrete pavements for low volume road. (8 Hours)



Surya Kant Sahdeo <suryasahdeo@iitmandi.ac.in>

External Reviewer Comments for New Proposed Course in the upcoming semester

2 messages

Surya Kant Sahdeo <suryasahdeo@iitmandi.ac.in>

Fri, Oct 4, 2024 at 12:11 PM

To: Praveen Kumar <praveen.kumar@ce.iitr.ac.in>

I am planning to propose a new elective course for PG, and Ph.D. students in Pavement Engineering for the upcoming semester at IIT Mandi. I have attached the course details and curriculum for your review. I would greatly appreciate any feedback or suggestions you might have regarding this proposal. Please let me know if any modifications are required or if the course can be accepted as it is. Thank you for your time and consideration. I look forward to your valuable input (if any).

Regards,
Surya

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Always work for society first - Prof BB Pandey

Surya Kant Sahdeo, Ph.D.
Assistant Professor
School of Civil and Environmental Engineering (SCENE)
Indian Institute of Technology, Mandi,
Kamand, Himachal Pradesh, BHARAT, 175075
Ph: +919475181646



Advanced Pavement Technology.docx

213K

Praveen Kumar <praveen.kumar@ce.iitr.ac.in>

Sat, Oct 5, 2024 at 11:10 AM

To: Surya Kant Sahdeo <suryasahdeo@iitmandi.ac.in>

It's good. Please go ahead.
Best wishes

Prof Praveen Kumar
Head, Civil Engineering Department
(Ex-Director, NIT Delhi)
MoRTH Chair Professor
Transportation Engineering Group
Department of Civil Engineering
Indian Institute of Technology (IIT)
Roorkee-247667 (Uttarakhand)
Phone 01332-285470; 285219 (O)
01332-285616 (R)
Mobile 9412307245
Alternative email praveenaeron@gmail.com, head@ce.iitr.ac.in
Member, Board of Governors, IIT-BHU
Coordinator, Principal Technical Agency, PMGSY
National Coordinator for Rural Infrastructure under Unnat Bharat Abhiyan

Visitor's Nominee for All IITs and All NITs for Civil Engg.

Formerly

Visitor Nominee for IITD, IITM, IITJ, IITH, IITBhuv and BHU

Associate Dean, IIT Roorkee

From: "Surya Kant Sahdeo" <suryasahdeo@iitmandi.ac.in>

To: "Praveen Kumar" <praveen.kumar@ce.iitr.ac.in>

Sent: Friday, October 4, 2024 12:11:13 PM

Subject: External Reviewer Comments for New Proposed Course in the upcoming semester

[Quoted text hidden]



Advanced Pavement Technology.docx
213K

R NGDRansinchung <g.n@ce.iitr.ac.in>
To: Surya Kant Sahdeo <suryasahdeo@iitmandi.ac.in>

Fri, Oct 4, 2024 at 5:51 PM

Dear Prof Surya Kant,

Draft submitted for review of proposal for a new course at your institute is thoroughly reviewed and found satisfactory by and large, however, I have suggested few minor additions marked with red color in each course contents that may further strengthen the course curriculum. Yellow marked may be deleted.

From my side, the draft is good enough to float in its presence form by incorporating the suggestions in their respective course contents.

My best wishes,

G.D. Ransinchung R.N.

From: "Surya Kant Sahdeo" <suryasahdeo@iitmandi.ac.in>
To: "R NGDRansinchung" <g.n@ce.iitr.ac.in>
Sent: Friday, October 4, 2024 3:00:02 PM
Subject: Fwd: External Reviewer Comments for New Proposed Course

[Quoted text hidden]



Advanced Pavement Technology (4).docx
212K



SCENE Office <office_scene@iitmandi.ac.in>

New Course Proposal for upcoming semester CE 5XXX

Surya Kant Sahdeo <suryasahdeo@iitmandi.ac.in>

Tue, Oct 8, 2024 at 10:51 AM

To: Sandip Kumar Saha <sandip_saha@iitmandi.ac.in>

Cc: Chairperson SCENE <chair_scene@iitmandi.ac.in>, Mamta <office_scene@iitmandi.ac.in>, R Prasanna <prasanna@iitmandi.ac.in>

Dear Dr. Sandeep,

Thank you for your email. Regarding the elective course,, I would need a classroom for theoretical sessions. For the practical component, the current Transportation Engineering lab should be sufficient for conducting the required experiments, so no additional lab space is necessary at this time.

In terms of financial requirements, I may need support for consumables to run the lab efficiently and for the maintenance of equipment, (if required). Should any unforeseen issues arise, I am confident that I can rely on the guidance and expertise of our chairperson to address them effectively.

Regards,
Surya

On Tue, Oct 8, 2024 at 9:55 AM Sandip Kumar Saha <sandip_saha@iitmandi.ac.in> wrote:

Dear Surya,

As discussed with the school chair, it is requested to submit the details of the space and financial implications for this course to the school for consideration of necessary approval.

Without ensuring the logistics, new course may not be possible to run.

Thanks and regards,
Sandip.

On Sat, 5 Oct, 2024, 14:12 Surya Kant Sahdeo, <suryasahdeo@iitmandi.ac.in> wrote:

Dear sir,

PFA provides all documents for the new course at the upcoming semester for PG/PhD students for your approval in the upcoming BoA meeting.

@Mamta for your office records and necessary action. Also Please let me know if any more details are required.

Regards,
Surya**Always work for society first - Prof BB Pandey**

Surya Kant Sahdeo, Ph.D.
Assistant Professor
School of Civil and Environmental Engineering (SCENE)
Indian Institute of Technology, Mandi,
Kamand, Himachal Pradesh, BHARAT, 175075
Ph: +919475181646



Always work for society first - Prof BB Pandey

Surya Kant Sahdeo, Ph.D.
Assistant Professor
School of Civil and Environmental Engineering (SCENE)
Indian Institute of Technology, Mandi,
Kamand, Himachal Pradesh, BHARAT, 175075
Ph: +919475181646



IIT Mandi

Proposal for a New Course

Course number	: CE528
Course Name	: Design of Masonry Structures
Credit Distribution	: 3-0-0-3
Intended for	: UG/PG elective
Prerequisite	: CE 351 – Design of Reinforced Concrete Structures
Mutual Exclusion	: None

1. Preamble:

This course provides a comprehensive coverage of the art and science of designing masonry structures. Masonry, one of the oldest and most enduring construction methods, has stood the test of time and continues to be a vital component of our built environment. This course has been meticulously crafted to equip students with the knowledge and skills needed to understand, analyze, and design masonry structures, with a particular emphasis on earthquake-resistant design.

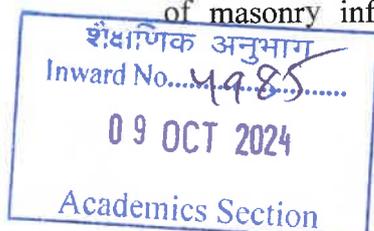
2. Course Modules with quantitative lecture hours:

Module 1 - Historical Perspective of Masonry Structures: Different types of masonry structures (Domes, Buildings, Bridges, Arches, etc.); Traditional/Heritage masonry structures; Foundations and site selection; Behavior of masonry structures during past earthquakes: Common modes of failure, effect of unit shapes and mortar type, effect of roof and floor systems, Common deficiencies. [6 hours]

Module 2 - Masonry Properties: Masonry units- stones, brick and concrete blocks, hollow and solid units; Manufacturing process; Mortar, grout and reinforcement; Various tests and standards, Stress-Strain Characteristics [6 hours]

Module 3 - Masonry Under Compression: Prism strength, Failure mechanism, types of construction and bonds; Eccentric loading; Slenderness – effective length and effective height, effect of openings; Code provisions. [8 hours]

Module 4 - Masonry Under Lateral Loads: In-plane and out-of-plane loads, bending parallel and perpendicular to bed joints; Shear and flexure behavior of piers; Test and standards; Analysis of perforated shear walls, lateral force distribution for flexible and rigid diaphragms; Arching action; Combined axial and bending actions; Masonry infills: Effect of masonry infills on seismic behavior of framed buildings, Failure modes, Code



provisions. [10 hours]

Module 5 - Earthquake Resistant Measures: Analysis for earthquake forces, role of floor and roof diaphragm; Concept and design of bands, bandages, splints, and ties; Reinforced masonry; Vertical reinforcement at corners and jambs; Measures in random-rubble masonry; Introduction to confined masonry [8 hours]

Module 6 - Retrofitting of Masonry Building: Techniques of repair and retrofitting of masonry buildings; IS: 13935-1993 provision for retrofitting. [4 hours]

3. Textbook:

- MJN Priestley and T Paulay 1997 Seismic design and assessment of reinforced concrete and masonry buildings, John Wiley and Sons.
- RG Drysdale, AA Hamid, LR Baker 1994 Masonry Structures: Behaviour and Design, Prentice Hall, New Jersey, USA,

4. References:

- AW Hendry 1981 Structural Brickwork, The Macmillan Press Ltd.
- R E Klingner 2010 Masonry structural design, McGrawHill Companies, Inc. New York
- M Tomazevic 1999 Earthquake-resistant design of masonry buildings, Series on Innovation in Structures and Construction, Vol. 1, Imperial College Press, London.
- National Building Code of India 2016 Vol.1, Part 6 Section 4 Structural Design - Masonry
- IS 1905: 1987, Handbook on Masonry Design and Construction.
- IS 17848 : 2022: Confined Masonry For Earthquake Resistance Code of Practice

5. Similarity with the existing courses:

(Similarity content is declared as per the number of lecture hours on similar topics)

S.No	Course Code	Similarity Content	Approx. % of Content
1	CE 610	Retrofitting and strengthening of structures, design guidelines for reinforced masonry building	<7%

6. Justification of new course proposal if cumulative similarity content is >30%:

NA

Approvals:

Other Faculty interested in teaching this course: –

Proposed by: Dr. Thainswemong Choudhury and Dr. Shivang Shekhar
School: SCENE

Signature: 

Date: 04/10/2024

Recommended/Not Recommended, with Comments:

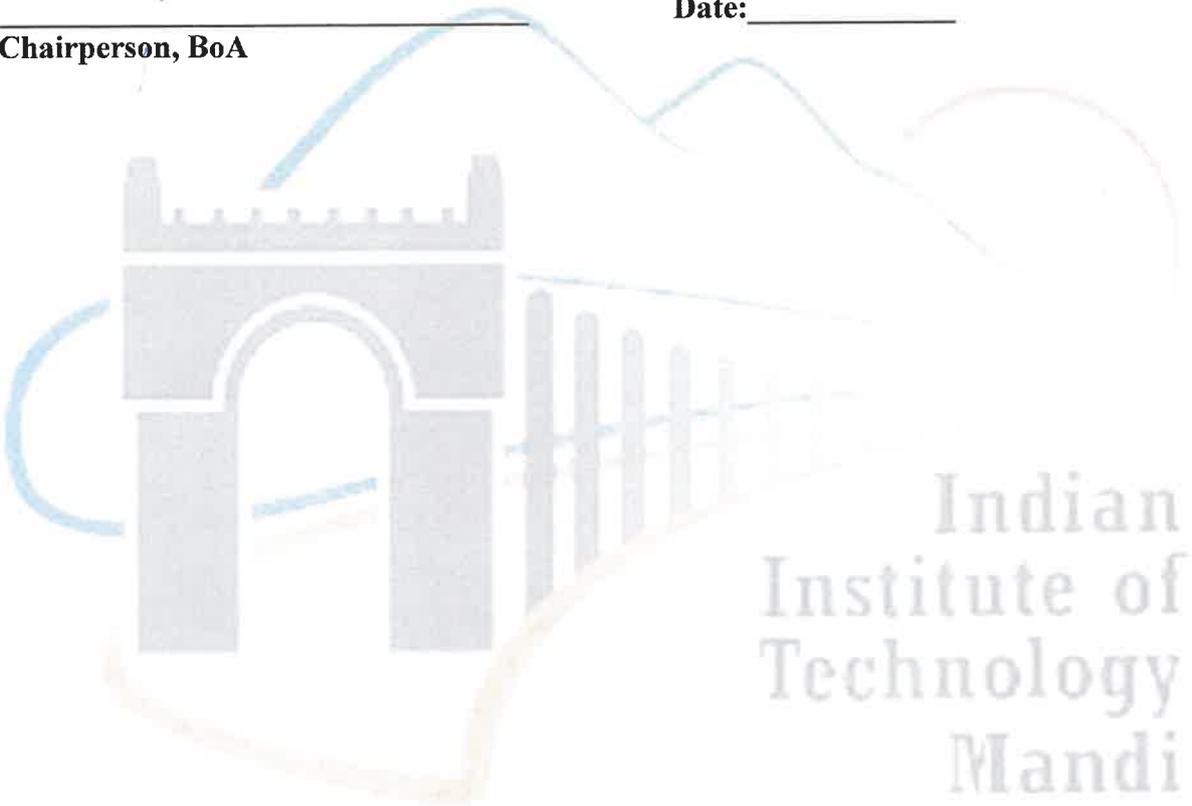

Chairperson, CPC

Date: _____

Approved / Not Approved

Chairperson, BoA

Date: _____



IIT Mandi
Proposal for a New Course

Course number : CE 352P
Course Name : Transportation Engineering Laboratory
Credit Distribution : 0-0-2-1
Intended for : UG Civil Engineering
Prerequisite : None
Mutual Exclusion : None

1. Preamble:

Transportation Engineering Laboratory, where a dynamic and essential component of our comprehensive engineering curriculum is presented. This course serves as a bridge between theoretical knowledge and real-world applications in transportation engineering. Through hands-on experiments, data analysis, and innovative problem-solving, invaluable insights will be gained into the design, analysis, and optimization of transportation systems. Our state-of-the-art facilities will guide the students in exploring traffic flow dynamics, pavement materials quality assurance and control, and traffic surveys. The laboratory session offers students a unique opportunity to acquire the skills and expertise needed to shape the future of transportation infrastructure.

2. Course Modules with quantitative lecture hours:

Laboratory/practical/tutorial Modules:

S. No	Experiments
1	Abrasion Test (Los Angeles, Devel abrasion, etc.)
2	California Bearing Ratio Test for Subgrade (including proctor density)
3	Tests on Bitumen: Penetration
4	Tests on Bitumen: Softening Point
5	Tests on Bitumen: Ductility
6	Tests on Bitumen: Viscosity
7	Tests on Bitumen: Flash and Fire point
8	Tests on Bitumen: Specific Gravity and Water Content
9	Marshal Stability Tests (including rotary evaporator)
10	Bankmen's Beam Test and MERLIN Test
11	Road Survey- Cross section, Super elevation camber, gradient
12	Measuring spot speed/ Flow/ Density/ vehicle count

10	Bankmen's Beam Test and MERLIN Test
11	Road Survey- Cross section, Super elevation camber, gradient
12	Measuring spot speed/ Flow/ Density/ vehicle count

2. Textbooks:

- Khanna S.K. and C.E.G. Justo, "Highway Engineering", Nemchand Bros, (2002) 2.
- Kadyali L. R.; Highway Engineering, Nem Chand & Brothers, Roorkee(2002)

3. Similarity with the existing courses:

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Course Code	Similarity Content	Approx. % of Content
1.			

6. Justification of new course proposal if cumulative similarity content is >30%:

"To benefit undergraduate students, we have included essential sub-tests as part of the existing testing procedures." For experiments no 4, 5, 6, 10

Approvals:

Faculty interested in teaching this course: –

Proposed by: Dr Surya Kant Sahdeo

School: SCENE

Signature:

SKS

Date: 29/8/24

The following faculty (at least 3 faculty) discussed on.....and approved the proposal on.....

Sl. No	Faculty Name	Signature
1	Dr Shivang Shekhar	<i>SSK</i>
2	Dr Kala Venkat Uday <i>venkata</i>	<i>Uday</i>
3	Dr Mahesh Reddy	<i>G. mahesh Reddy</i>



SCENE Office <office_scene@iitmandi.ac.in>

Modification of Existing Lab Course CE 352P proposal submission

5 messages

Surya Kant Sahdeo <suryasahdeo@iitmandi.ac.in>

Tue, Oct 8, 2024 at 4:55 PM

To: scene@iitmandi.ac.in

Cc: Mamta <office_scene@iitmandi.ac.in>, Chairperson SCENE <chair_scene@iitmandi.ac.in>, Preeti Rana <office_sceneoa1@iitmandi.ac.in>

Dear all,

Please find the attached Proposal regarding modification of existing lab course CE 352P. This modified proposal is evaluated by three internal faculties namely Prof. Shivang; Dr Uday and Dr Mahesh. **The modification/ changes are highlighted in yellow.**

The existing lab course is also attached for your reference.

To benefit undergraduate students, it is necessary to include essentials subtests as a part of the existing course for basic and clear understanding of the concepts.

Please let me know if you have any feedback or suggestions.

Best,
Surya



Always work for society first - Prof BB Pandey

Surya Kant Sahdeo, Ph.D.
Assistant Professor
School of Civil and Environmental Engineering (SCENE)
Indian Institute of Technology, Mandi,
Kamand, Himachal Pradesh, BHARAT, 175075
Ph: +919475181646

2 attachments

 **Old CE-352P.pdf**
132K

 **New CE- 352P.pdf**
3843K

Surya Kant Sahdeo <suryasahdeo@iitmandi.ac.in>

Tue, Oct 8, 2024 at 5:02 PM

To: Sandip Kumar Saha <sandip_saha@iitmandi.ac.in>

Cc: Mamta <office_scene@iitmandi.ac.in>, Preeti Rana <office_sceneoa1@iitmandi.ac.in>

Dear Dr. Sandeep,

For the practical component, the current Transportation Engineering lab should be sufficient for conducting the required experiments of **CE 352P**, so no additional lab space is necessary.

In terms of financial requirements, I may need support of consumables to run the lab efficiently and for the maintenance of equipment, (if required) and some instruments as highlighted in the pdf in yellow. Should any unforeseen issues arise, I am confident that I can rely on the guidance and expertise of our chairperson to address them effectively.

Regards,
Surya

[Quoted text hidden]

Sandip Kumar Saha <sandip_saha@iitmandi.ac.in> Wed, Oct 9, 2024 at 9:01 AM
To: Surya Kant Sahdeo <suryasahdeo@iitmandi.ac.in>
Cc: Mamta <office_scene@iitmandi.ac.in>, Preeti Rana <office_sceneoa1@iitmandi.ac.in>, R Prasanna <prasanna@iitmandi.ac.in>, Chairperson SCENE <chair_scene@iitmandi.ac.in>

Dear Surya,

I hope that you have already communicated the tentative financial implications for the new instrument to the school for necessary approval. As this is a core course, there must be some contingency plan to complete the lab effectively with the amended content if the new equipment is not ready to use by the next offering.

I request you to initiate the financial approval process, if not done already, through appropriate channels. I have copied the mail to the School Chair for his information and necessary action in this regard.

Thanks and regards,
Sandip.

[Quoted text hidden]

Rajnish Sharma <rsharma@iitmandi.ac.in> Wed, Oct 9, 2024 at 11:21 AM
To: Surya Kant Sahdeo <suryasahdeo@iitmandi.ac.in>
Cc: scene@iitmandi.ac.in, Mamta <office_scene@iitmandi.ac.in>, Chairperson SCENE <chair_scene@iitmandi.ac.in>, Preeti Rana <office_sceneoa1@iitmandi.ac.in>

Dear Dr Surya

As discussed earlier, kindly also prepare the financial implications due to these changes in the course and discuss them with Dr. Sandeep and me.

On Tue, Oct 8, 2024 at 4:55 PM Surya Kant Sahdeo <suryasahdeo@iitmandi.ac.in> wrote:

[Quoted text hidden]

Surya Kant Sahdeo <suryasahdeo@iitmandi.ac.in> Wed, Oct 9, 2024 at 12:46 PM
To: Sandip Kumar Saha <sandip_saha@iitmandi.ac.in>
Cc: Mamta <office_scene@iitmandi.ac.in>, Preeti Rana <office_sceneoa1@iitmandi.ac.in>, R Prasanna <prasanna@iitmandi.ac.in>, Chairperson SCENE <chair_scene@iitmandi.ac.in>

Dear Dr Sandip,

Financial implications for running CE352P is already discussed with our chairperson and its approval is on the way following our discussion with Dr Uday who is also the co-tutor of this course. The modification is required since some of the experiment's details need substantial modification on content. It should be changed and some supporting tests need to be included for basic understanding of the subject considering UG students' requirements which are proposed in the modified course proposed.

Guide me how to move forward in this regard.

Regards
Surya



Always work for society first - Prof BB Pandey

Surya Kant Sahdeo, Ph.D.
Assistant Professor
School of Civil and Environmental Engineering (SCENE)

**Indian Institute of Technology, Mandi,
Kamand, Himachal Pradesh, BHARAT, 175075
Ph: +919475181646**

On Wed, 9 Oct 2024 at 09:01, Sandip Kumar Saha <sandip_saha@iitmandi.ac.in> wrote:

Dear Surya,

I hope that you have already communicated the tentative financial implications for the new instrumen to the school for necessary approval. As this is a core course, there must be some contingency plan to complete the lab effectively with the amended content if the new equipment is not ready to use by the next offering.

I request you to initiate the financial approval process, if not done already, through appropriate channels. I have copied the mail to the School Chair for his information and necessary action in this regard.

Thanks and regards,
Sandip.

On Tue, 8 Oct, 2024, 17:03 Surya Kant Sahdeo, <suryasahdeo@iitmandi.ac.in> wrote:

Dear Dr. Sandeep,

For the practical component, the current Transportation Engineering lab should be sufficient for conducting the required experiments of **CE 352P**, so no additional lab space is necessary.

In terms of financial requirements, I may need support of consumables to run the lab efficiently and for the maintenance of equipment, (if required) and some instruments as highlighted in the pdf in yellow. Should any unforeseen issues arise, I am confident that I can rely on the guidance and expertise of our chairperson to address them effectively.

Regards,
Surya

[Quoted text hidden]

IIT Mandi

Proposal for a New Course

Course number : CE 352P
Course Name : Transportation Engineering Laboratory
Credit Distribution : 0-0-2-1
Intended for : UG Civil Engineering
Prerequisite : None
Mutual Exclusion : None

1. Preamble:

Transportation Engineering Laboratory, where a dynamic and essential component of our comprehensive engineering curriculum is presented. This course serves as a bridge between theoretical knowledge and real-world applications in transportation engineering. Through hands-on experiments, data analysis, and innovative problem-solving, invaluable insights will be gained into the design, analysis, and optimization of transportation systems. Our state-of-the-art facilities will guide the students in exploring traffic flow dynamics, pavement materials quality assurance and control, and traffic surveys. The laboratory session offers students a unique opportunity to acquire the skills and expertise needed to shape the future of transportation infrastructure.

2. Course Modules with quantitative lecture hours:

Laboratory/practical/tutorial Modules:

S. No	Experiments
1	Los Angles Abrasion Test of Bitumen
2	Devel's abrasion Test of Bitumen
3	CBR Test
4	Marshall Stability of Bitumen
5	Penetration Test of Bitumen
6	Softening Point of Bitumen
7	Flash and Fire point of Bitumen
8	Ductility of Bitumen
9	Viscosity of Bitumen
10	Banklmen's Beam Test
11	Road Survey- Cross section, Super-Elevation Camber, Gradient
12	Measuring Spot Speed/Flow/Density/Vehicle Count

3. Text books:

- 1) S.K. Khanna, C.E.G. Justo and A. Veeraraghavan, 'Highway Engineering', Nem Chand Bros., 10th Edition, 2018.
- 2) Kadiyali L.R., 'Principles and Practice of highway Engineering', Khanna Publishers, Delhi, 1992.

4. References:

- IS Standards for each test
- "Transportation Engineering: Planning and Design" by Paul H. Wright and Norman J. Ashford -
- "Traffic and Highway Engineering" by Nicholas J. Garber and Lester A. Hoel

1. Similarity with the existing courses:

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.		Course Code	Similarity Content	Approx. % of Content
1.	nil			

6. Justification of new course proposal if cumulative similarity content is >30%: N.A.



IIT Mandi Proposal for a New Course

Course number : IC241
Course Name : Materials Science for Engineers
Credit : 3
Distribution : 3-0-0-3
Intended for : B.Tech.
Prerequisite : None
Mutual Exclusion : None (*courses with high similarity not allowed to credit by the students after or along with this course*)

1. Preamble:

Materials are an integral part of the technological development. The objective of this course is to impart basic essential knowledge about materials to the engineering graduates. By the end of this course the student should be able to understand different classes of materials available for various applications, selection strategies, and properties that influence the behavior of materials and how to use them for variety of engineering applications such as mechanical, medical, electronic, packaging and, transport.

2. Course Modules with quantitative lecture hours:

Module-I: Introduction:

Overview of materials science and materials engineering, Materials tetrahedron; structure – property correlations, processing, Materials selection strategies; Property considerations for specific application, Ashby-style charts, Impact of bonding and structure over materials properties. Classes of engineering materials; metals, polymers, ceramics, composites, and their properties. Crystal structures and microstructures in materials: Amorphous, crystalline, and polycrystalline materials, Crystalline defects, and their significance. [10 Hours]

Module-II: Structural Materials and Applications

Iron, steel, light weight metals, alloys, polymers and composites, materials for automotive, railways, aircrafts, and the future VTOLs and Hyperloops, defense, marine and oil & gas sectors. Uniaxial stress, strain, engineering and true stress and strain, stress strain diagrams, elastic, yielding and plastic behaviour, effect of temperature and creep. Application of metals, ceramics, polymers, and composites in static structures like buildings, bridges, furnace structure, bulb filaments, etc, strength requirement in transmission lines. [10 Hours]

Module-III: Optoelectronic Materials and Applications

Band structures for conductors, semiconductors and insulators, I-V characteristics, resistance of alloy, and conductor alloy. Light interactions with solids, refraction, reflection, absorption and transmission, luminescence, photoconductivity, lasers and optical fibre communications, photovoltaics, light emitting diodes, photodetector. [6 Hours]

Module – IV: Dielectric, Magnetic, Superconductors and their applications

Dielectric Materials - Polarization mechanisms, frequency dependence of dielectric constant and dielectric loss, piezo, ferro and pyro-electricity-elemental ideas. Choice of materials for various specific applications: capacitors, sensors, actuators, and transducers, in the context of applications. Magnetic materials: dia, para, ferro, antiferro and ferrimagnetism. Soft and Hard magnetic materials, magnetic sensors, read- write heads, spintronic devices. Superconducting materials; zero resistance and Meissner effect. Type I and Type II superconductors. High temperature superconducting materials and their applications. [10 Hours]

Module-V: Advanced Materials and Sustainability

Nanomaterials, Biomaterials, Smart Materials, Energy Materials, Materials for clean energy and carbon capture, Recycling, Waste management, Environmental Degradation, Sustainability and Green Engineering etc. [6 Hours]

3. Text books:

- Materials Science and Engineering- An introduction, William D. Callister, Jr. John Wiley and Sons, Inc.
- Introduction to Materials Science for Engineers, James F Shackelford
- Elements of Materials Science and Engineering, Lawrence H. Van Vlack, Addison-Wesley Publishing Company.
- Principles of Materials Science and Engineering, W.F. Smith, McGraw-Hill.
- Engineering Materials and Their Applications, R.A. Flinn and P.K. Trojan, Haughton.

4. References:

Engineering Materials: Properties and Selection by Kenneth G. Budinski, Prentice Hall, [New Edition] USA.

Principles of Electronic Materials and devices by S. O. Kasap

5. Similarity with the existing courses: (Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Course Name	Course Code	Similarity Content	Approx. % of Content
1.				
2.				

6. Justification of new course proposal if cumulative similarity content is >30%:

NA

Approvals:

Other Faculty interested in teaching this course: –

Prof.. Rahul Vaish, Dr. Sudhir Pandey, Dr. Jaspreet, Dr. Rik Koner, Dr. Swati, Dr. Ravindra, Dr. Sandeep Sahu, Dr. Neha Shukla

Proposed by: Prof.. Rahul Vaish,

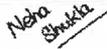
School: SMME



Signature

Date:03/10/2024

The following faculty (at least 3) discussed the proposal on 24/09/2024 and approved it on 03/10/2024.

Sl. No	Faculty Name	Signature
1.	Dr. Ravindra Naik Bukke	
2.	Dr. Neha Shukla	
3.	Dr. Viswanath Balakrishna	

School Chair: 

7/10/24

School:

Date:

This proposal is reported inthe Board of Academics on

Dean Academics

Date:

Note: School is responsible for the Course Code. The Academic Office provides the IC Course Code.

IIT Mandi
Proposal for a New Course

Course number : ME210P
Course Name : Fluid Mechanics Lab
Credit : 1
Distribution : 0-0-2-1
Intended for : UG
Prerequisite : ME210 – Fluid Mechanics
Mutual Exclusion : NA

1. Preamble:

To introduce students to different fluid systems and their evaluation.

2. Course Modules with quantitative lecture hours:

NA

Laboratory/practical/tutorial Modules:

- 1) **Flow Visualization**
- 2) **Validation of Bernoulli's Theorem**
- 3) **Application of Flow Measuring Devices**
- 4) **Major & Minor Losses in Pipes**
- 5) **Measurement of Pipe Friction Factor**
- 6) **Identifying Losses in Pipe Fittings**
- 7) **Static Pressure Measurement in a Wind Tunnel**
- 8) **Performance Analysis of Francis & Pelton Turbine**
- 9) **Determination of Metacentric Height**
- 10) **Measurement of Lift & Drag on an Aero-foil**
- 11) **Calibration of Various Notches**
- 12) **Momentum Eqn. Verification Using Jet Impaction**
- 13) **Vortex Flow Measurement**
- 14) **Pitot Static Tube Calibration**

3. Text books:

- J. P. Holman, Experimental Methods for Engineers, 7th edition, Tata McGraw-Hill 2001.
- T.G. Beckwith, J.H. Lienhard V, R. D. Marngoni, Mechanical Measurements, 5th edition, Pearson Education, 2010.
- E.O. Doebelin, Measurement systems, Application and Design, 5th edition, Tata McGraw-Hill, 2008
- Fox and Mc Donald, Introduction to Fluid Mechanics, 7th Edition, John Wiley, 2009

4. References:

NA

5. Similarity with the existing courses:

(Similarity content is declared as per the number of lecture hours on similar topics)

NA

S. No.		Course Code	Similarity Content	Approx. % of Content	
1.					

6. Justification of new course proposal if cumulative similarity content is >30%:

NA

Approvals:

Faculty interested in teaching this course: –

Dr Gajendra Singh, Dr Atul Dhar, Dr Sarthak Nag, Dr. Parmod Kumar

Proposed by: Dr. Gajendra Singh

School: SMME

Signature:

Date:

The following faculty (at least 3 faculty) discussed on.....and approved the proposal on.....

S. No	Faculty Name	Signature

School Chair: Dr Atul Dhar

School: SMME

Date:

This proposal is reported inthe Board of Academics on

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.



IIT Mandi Proposal for a New Course

316

Course number : ME3XX
Course Name : Automotive Engine Design
Credit Distribution : (format: 3-0-0-3, replace with relevant numbers)
Intended for : UG 3rd, 4th year, and PG students
Prerequisite : IC140 Graphics for Design
Mutual Exclusion : None

1. Preamble:

The course provides an overview of the IC engine design. The learning outcomes will be as follows: How does an IC engine works and the typical types of IC engines in the current market; Internal architecture of a typical IC engine; Understanding the design of crank train, valve train, and gear train. Impact of fuel on engine performance; Dynamic balancing of IC engine; How to design/select engine components including bearing selection.

2. Course Modules with quantitative lecture hours:

Unit 1: Understanding General Engine Specification

Explanation of the engine specification of a typical 2-wheeler and a 4-wheeler engine. Fundamental difference between SI and CI Engines. Correlation of piston movement and air standard cycles for 2 Stroke & and 4 Stroke Engines. Understanding the impact of engine displacement, bore, stroke, and bore-to-stroke ratio.

(6 Hours)

Unit 2: Head & Block Design

Combustion chamber design: SI, DISI, IDI, CI, etc. Valve port and manifold design. Understanding swirl, tumble, supercharging, and turbocharging in engines. Engine block design for air cooled and water-cooled engine. Understanding design and manufacturing of cylinder liner. Learning various fuel injection systems: PFI, GDI, Carburetor, etc.

(10 Hours)

Unit 3: Crank Train Design

Definition of crank train function and terminology. Common crank train configurations. Design of piston, piston rings, connecting rods, crankshafts, balancer shaft, and flywheel, Dynamic balancing and configuring engine firing order.

(12 Hours)

Unit 4: Valve Train Design:

Overview of valve train. Design and manufacturing of camshaft. Current status of valvetrains VVT, 4-Valve, 3-Valve, 2-Valve, etc. Dynamics of valve train.

(6 Hours)

Unit 4: Gear Train Design:

Definition of typical gear trains: CVT, DSG, DCT, etc. Function of Clutch. Working of gear shifting mechanism. Design/selection of gears and bearings. Lubrication and oil pump in a single-cylinder engine.

(8 Hours)

Laboratory/practical/tutorial Modules:

3. Textbooks:

- Vehicular Engine Design, Kevin Hoag & Brian Dondlinger, Springer
- Design of Automotive Engines, A Kolchin & V Demidov, MIR Publishers

4. Reference Books:

- Diesel-Engine Management, Robert Bosch GmbH
- Gasoline-Engine Management, Robert Bosch GmbH
- Internal Combustion Engines, JB Heywood, McGraw Hills
- Internal Combustion Engines, V Ganeshan, McGraw Hills
- Automotive Engine Design, William H Crouse, McGraw Hills

5. Similarity with the existing courses:

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.		Course Code	Similarity Content	Approx. % of Content
1.	IC Engine	ME355	Basics of IC Engine from Unit 1 Only	< 10%

6. Justification of new course proposal if cumulative similarity content is >30%:

Not Applicable

Approvals:

Other Faculty interested in teaching this course: – Dr Atul Dhar, Dr Sarthak Nag

Proposed by: Gajendra Singh

School: SMME

Signature:

Gajendra Singh
03/10/24

Date: 01st October 2024

Recommended/Not Recommended, with Comments:

Chairperson, CPC

Date:

[Signature]
31/10/24

Approved / Not Approved

Chairperson, BoA

Date: _____



IIT Mandi Proposal for a New Course

ME 527

Course number : ME5XX
Course Name : Biofluid Dynamics
Credit Distribution : (format: 3-0-0-3, replace with relevant numbers)
Intended for : UG final year, and PG students
Prerequisite : ME210 or Equivalent Fluid Mechanics Course
Mutual Exclusion : None

1. Preamble:

The Biofluid Mechanics course explores the practical application of fluid mechanics principles within major human organ systems. As an introductory course, it delves into physiologically relevant fluid flow phenomena, emphasizing the underlying physical mechanisms from an engineering perspective. The primary focus is on integrating various fluid mechanics concepts to address relevant problems within the human body. An essential objective of the course is to foster broad knowledge and critical thinking related to current research challenges in biological fluid dynamics.

Topics Covered:

- Rheology of blood
- Blood vessel mechanics
- Unsteady blood flow
- Cardiovascular physiology
- Intraventricular flow dynamics
- Fluid mechanics of vascular diseases
- Fluid dynamics of thrombogenesis
- Blood flow and pressure measurement technique
- Laryngeal airflow
- Airflow in the respiration system

2. Course Modules with quantitative lecture hours:

Unit 1: Review of Basic Fluid Mechanics:

Fluid Properties; Pressure and Buoyancy; Flow Phenomena (*Laminar flow and turbulent flow; Equation for mass, momentum, and energy conservation in incompressible, frictionless fluids*); Viscosity and Resistance (*Poiseuille's law for laminar flow resistance in tubes*)

(6 Hours)

Unit 2: Biorheology:

Newtonian and non-Newtonian fluids. Understanding how these macromolecules respond to mechanical forces. Investigating the flow properties of large biological molecules.

(6 Hours)

Unit 3: Hemodynamics:

Circulation in the heart, blood and lymphatic vessels. Blood properties. Steady flow in tubes. Pulsatile flow in a rigid tube. Pulsatile flow in an elastic tube. Blood flow dynamics in arteries and veins. Microcirculation. Flow in specific vessels and arteries. Heart-valve hemodynamics. Diseases related to obstruction of blood flow.

(10 Hours)

Unit 4: Respiratory Biofluid Dynamics:

Flow in the upper and lower airways. Alveolar ventilation. Airflow in the lungs. Mechanics of breathing. Gas exchange and transport.

(6 Hours)

Unit 4: Cardiovascular Implants & Drug Delivery Systems:

Function of artificial heart valves and devices (pressure distribution and fluid flow). Evaluation of cardiovascular and peripheral stents. Inhalation delivery systems such as propellant-metered dose inhalers, and dry powder inhalers (drug dispersion and flow behavior).

(10 Hours)

Unit 6: Blood Flow and Pressure Measurement Technique:

Mechanics of Sphygmomanometer and Stethoscope. Heart sound and cardiac auscultation.

(4 Hours)

Laboratory/practical/tutorial Modules:

3. Text books:

- McDonald's Blood Flow in Arteries: Theoretical, Experimental and Clinical Principles by Wilmer W. Nichols and Michael F. O'Rourke. Hodder Arnold Publication
- Biofluid Mechanics in Cardiovascular Systems, Lee Waite, McGraw-Hill
- Goyal , Megh R, Biofluid Dynamics of Human body systems, CRC Press, 2013.
- C. Kleinstreuer, Biofluid Dynamics: Principles and Applications, CRC Press, Taylor&Francis Group, 2006
- Ali Ostadfar, Biofluid Mechanics: Principles and Applications , Elsevier, 2016

4. References:

- Biofluid Mechanics 535.661, Johns Hopkins University, School of Engineering
- Biofluid Dynamics MEC433, UBC College of Engineering
- Bio Fluid Mechanics (MTR003), Imperial College London
- BEE 3310 Bio-Fluid Mechanics, Cornell SCE
- BMED/ME 4757 Biofluid Mechanics, Georgia Institute of Technology

5. Similarity with the existing courses:

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.		Course Code	Similarity Content	Approx. % of Content
1.	Fluid Mechanics	ME210	Some content from Unit 1 and 2	< 15%

6. Justification of new course proposal if cumulative similarity content is >30%:

Not Applicable

Approvals:

Other Faculty interested in teaching this course: – Dr Parmod Kumar,

Sarthak Nag

Proposed by: Gajendra Singh

School: SMME

Signature:

Gajendra Singh
03/10/24

Date: 01st August 2024

Recommended/Not Recommended, with Comments:

Chairperson, CPC

Date:

[Signature]
3/10/24

Approved / Not Approved

Chairperson, BoA

Date: _____

Indian
Institute of
Technology
Mandi



Re: Recommendation for Biofluid Dynamics course

From Daniele Vigolo <daniele.vigolo@sydney.edu.au>

Date Fri 2024-09-13 17:52

To gajendra <gajendra@iitmandi.ac.in>

Hi Gaj,

Sorry for the late reply, I have been unwell since last week and just came back to work yesterday.

I think your program is very well made and fairly complete. In particular I think Unit 1 is good and touches all the fundamentals (I'm assuming your students already did some fluid dynamics and this can be a recap). Maybe you can consider to discuss the derivation of the Navier-Stokes equation and the approximation for laminar steady flow (Stokes flow and Poisson flow equation).

Unit 2 is definitely important. I'd consider to extend to 6 hours as some of these concepts might be new for the students and it might take a bit longer to go through a few examples. You might also consider discuss some measurement techniques and show how a rheometer works.

Unit 3 is obviously critical and I think it has all it needs. I am working on some cardiovascular diseases such as deep vein thrombosis so I'm sure there is a lot to cover about these topics.

Unit 4: I am honestly not very familiar as I work with liquids. It looks very relevant and appropriate.

Unit 5 is very interesting. In my opinion the cardiovascular implants is the most interesting part. The effect of different geometries for example will be critical. The capability to replicate the heart performance is obviously critical and discussing this will be very interesting for the students. The drug delivery links to Unit 4 so it makes sense.

Unit 6 seems very short, maybe 4 hours are enough.

My suggestion would be to incorporate some information regarding computational fluid dynamics used to study complex geometries. There are a lot of publications on 3D CFD studies on the heart (related to specific diseases) and a lot of papers on arteries and vein flow dynamics. We also worked on the dynamics of thrombus formation in DVT using computational tools. This is something that is growing quite a lot in the past 10-20 years and could be relevant.

Another thing to consider is to add some discussion about AI and machine learning applied to biofluids. This is also a fascinating direction that is becoming more and more popular.

In general you did a great job, good luck delivering this course!

Best,

Daniele

DANIELE VIGOLO, PhD | Associate Head of School Research | Senior Lecturer

The University of Sydney | Sydney Nano Institute

Faculty of Engineering, School of Biomedical Engineering

Room 303, Engineering Link Building J13 | The University of Sydney | NSW | 2008

E daniele.vigolo@sydney.edu.au | **W** danielevigolo.com

T 02 8627 1437 | **X** @Vigolo_LAB

IIT Mandi

Proposal for a New Course

Course number	: ME600
Course Name	: Research Methodology
Credit	: 1
Distribution	: 1-0-0-1
Intended for	: MTech(R), PhD
Prerequisite	: None
Mutual Exclusion	: Research Methodology courses running in various schools

1. Preamble:

This course delves into the various research methodologies in sciences and engineering. The focus is on understanding what research is and how it is conducted in physical sciences and engineering. Students will learn how a research problem is formulated and how it is tackled with the scientific method. Students will become familiar with the methods of theoretical as well as the experimental research. They will also learn the importance of computational research and methods of numerical simulations. The course will culminate with an overview on the best practices of scientific communication with students having to write a technical report with LaTeX on their own research work.

2. Course Modules with quantitative lecture hours:

Unit 1: Overview of Research: Purpose of research, selection of a research problem, literature review and research gap, various research methodologies, overview of logical reasonings, the scientific method, hypothesis forming

(3 Hours)

Unit 2: Theoretical Research: Importance of theory in research, introduction to physical and mathematical modeling, methods of theoretical research

(1 Hour)

Unit 3: Experiments in Research: Introduction to experimental research, design of experiments, measurement techniques and instrumentation, uncertainty analysis, best practices in experiments, and ethical considerations in experimental research

(2 Hours)

Unit 4: Numerical Simulations in Research: Importance of computational research, advances and applications of computational techniques in various fields, common numerical methods and tools

(2 Hours)

Unit 5: Scientific Communication: Elements of scientific communication, introduction to LaTeX, best practices in writing reports, theses and journal articles

(6 Hours)

Laboratory/practical/tutorial Modules:

A technical report writing with LaTeX will be part of the course in which the student needs to submit a report based on one's own research work.

3. Text books:

1. Soumitro Banerjee, *Research Methodology for Natural Sciences*, IISc Press, 2022
2. Wayne Booth, Gregory Colomb, Joseph Williams, Joseph Bizup, William Fitzgerald, *The Craft of Research*, 4th edition, The University of Chicago Press, 2016

4. References:

1. Kate L Turabian, *A Manual for Writers of Research Papers, Theses and Dissertations*, 9th edition, The University of Chicago Press, 2018
2. John W. Creswell, J, David Creswell, *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 6th edition, SAGE Publications, 2022

5. Similarity with the existing courses:

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.		Course Code	Similarity Content	Approx. % of Content
1.	None	NA	NA	

6. Justification of new course proposal if cumulative similarity content is >30%:

Approvals:

Faculty interested in teaching this course: –

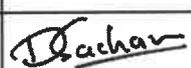
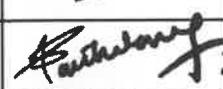
Proposed by: Dr Deepak Sachan

School: SMME

Signature: 

Date: Sept 02, 2024

The following faculty (at least 3 faculty) discussed and approved the proposal on.....

Sl. No	Faculty Name	Signature
1	Deepak Sachan	
2	Sarthak Nag	
3	Dube Dheeraj Prakashchand	

School Chair: Dr. Mrityunjay Doddamoni (Email attached)

School: SMME

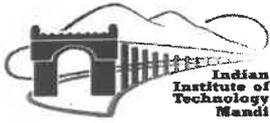
Date:

This proposal is reported inthe Board of Academics on

Dean Academics:

Date:

Note: School is responsible for the Course Code. The Academic Office provides the IC Course Code.



Anurag Rawat <anuragrawat@iitmandi.ac.in>

Fwd: RM600 course proposal for SMME students

2 messages

Gaurav Bhutani <gaurav@iitmandi.ac.in>

Tue, Sep 3, 2024 at 4:13 PM

To: SMME Office <smmeoffice@iitmandi.ac.in>

Cc: Deepak Sachan <Dsachan@iitmandi.ac.in>, Chairperson SMME <chairsmme@iitmandi.ac.in>

Dear SMME office,

Please forward it to the academic office with the Chair's signature.

Regards,
Gaurav

----- Forwarded message -----

From: **Deepak Sachan** <dsachan@iitmandi.ac.in>

Date: Mon, Sep 2, 2024 at 9:42 PM

Subject: Re: RM600 course proposal for SMME students

To: Gaurav Bhutani <gaurav@iitmandi.ac.in>

Cc: Sarthak Nag <sarthak@iitmandi.ac.in>, Dube Dheeraj Prakashchand <dheeraj@iitmandi.ac.in>

Dear Gaurav,

Please find the RM proposal attached. New course ID is ME600.

Thanks
-DeepakOn Tue, 20 Aug, 2024, 9:37 am Gaurav Bhutani, <gaurav@iitmandi.ac.in> wrote:
A gentle reminder please.

Dr Gaurav Bhutani
Assistant Professor
School of Engineering
Indian Institute of Technology Mandi
Kamand Campus
Mandi 175005
Himachal Pradesh, India
Tel: +91 1905-267108
Email: gaurav@iitmandi.ac.in

On Fri, 9 Aug 2024 at 15:22, Deepak Sachan <dsachan@iitmandi.ac.in> wrote:

Thanks for taking this up Dr Bhutani. We will get this done by next weekend.

We also need to propose a new course ID for this course. I propose **ME600** which, if okay with everyone, can be taken forward.Regards,
-Deepak

On Fri, Aug 9, 2024 at 3:09 PM Gaurav Bhutani <gaurav@iitmandi.ac.in> wrote:

Dear colleagues,

Based on your experience with teaching the Research Methodology course to SMME PG students, can you please propose a new course plan for RM600 for SMME.

I will appreciate if you can share this within 2 weeks. I will then take it to the BoA for approval.

Regards

Gaurav

Dr Gaurav Bhutani
Assistant Professor
School of Engineering
Indian Institute of Technology Mandi
Kamand Campus
Mandi 175005
Himachal Pradesh, India
Tel: +91 1905-267108
Email: gaurav@iitmandi.ac.in

--

Dr Gaurav Bhutani
Assistant Professor
School of Engineering
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 **ME600 (Research Methodology) Proposal Form.pdf**
240K

Chairperson SMME <chairsmme@iitmandi.ac.in>

Tue, Sep 3, 2024 at 4:30 PM

To: Gaurav Bhutani <gaurav@iitmandi.ac.in>

Cc: SMME Office <smmeoffice@iitmandi.ac.in>, Deepak Sachan <Dsachan@iitmandi.ac.in>

Approved.

[Quoted text hidden]

IIT Mandi

Proposal for a New Course

Course number : ME630
Course Name : Machine Learning for Engineers
Credit : 3
Distribution : 2-0-2-3
Intended for : MTech/ MTech(R)/MS(R)/PhD
Prerequisite : None
Mutual Exclusion: (Specify the equivalent courses in other schools. These *Courses (with high similarity) are not allowed to credit by the students after or along with this course.*)

1. Preamble:

Machine learning (ML) is important in engineering because it helps engineers analyze data, identify patterns, and make predictions about future behavior This course covers fundamental concepts and methods of computational data analysis, including pattern classification, prediction, visualization, and recent topics in machine learning. The course will give the student the basic ideas and intuition behind modern machine learning methods as well as a bit more formal understanding of how, why, and when they work. The lectures will cover the fundamental concepts and examples of developing machine learning models will be covered in lab using Python/MATLAB.

2. Course Modules with quantitative lecture hours:

- Unit 1 : Introduction:** Various learning paradigms, Data cleaning, Visualization and Preprocessing, Data Normalization, Linear Regression, Polynomial Regression [4hr]
- Unit 2 : Optimization:** gradient-based techniques, metaheuristic techniques, Genetic Algorithm (GA), numerical implementation [4hrs]
- Unit 3 : Statistics and probability:** Probability distributions, hypotheses testing, Bayes' theorem, Maximum likelihood parameter estimation, Bayesian parameter estimation [3hrs]
- Unit 4 : Supervised learning:** Linear/nonlinear regression, overfitting, regularization, logistic regression, naive Bayes, k-NN, decision tree, random forest, maximum likelihood, support vector machine, applications in engineering [7hrs]
- Unit 5 : Unsupervised learning:** Singular value decomposition, principal component analysis, clustering, applications in engineering [5hrs]
- Unit 6 : Artificial neural network:** Single- and multi-layer networks, activation, backpropagation, stochastic gradient descent, physics-informed neural network, applications in engineering [5hrs]

Laboratory/practical/tutorial Modules:

1. Introduction to Python/MATLAB [2hrs]
2. Extract the data from database [2hrs]
3. Implement Support Vector Machine for a dataset and compare the accuracy by applying the following kernel functions: i. Linear ii. Polynomial iii. RBF[2hrs]
4. Implement k-nearest neighbours classification [2hrs]
5. Implement linear regression using [2hrs]
6. Implement K-Means Clustering using [2hrs]
7. Implement Naive Bayes Theorem to Classify the English Text [2hrs]
8. Implement an algorithm to demonstrate Back Propagation Algorithm [2hrs]
9. Implement an algorithm to demonstrate the significance of Genetic Algorithm [2hrs]
10. Implement an algorithm to demonstrate Back Propagation Algorithm [2hrs]
11. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples[2hrs]

3. Text books:

1. *Machine Learning for Engineers*, R. G. McClarren, Springer
2. *A First Course in Machine Learning*, S. Røgera, M. Girolami, CRC Press

4. Reference

3. *Machine Learning*, Z-H. Zhou, Springer
4. *An Introduction to Statistical Learning*, G. James et al., Springer
5. *Data-Driven Science and Engineering*, S. L. Brunton, J. L. Kutz, Cambridge Uni. press
6. *Probabilistic Machine Learning for Civil Engineers*, J-A. Goulet, MIT Press
7. *Machine Learning Refined*, 2nd ed., J. Watt et al., Cambridge University press
8. *Machine Learning*, A. Lindholm et al., Cambridge University press

4. Similarity with the existing courses:

S. No.	Course Name	Course Code	Similarity Content	Approx. % of Content
1.	Pattern Recognition	CS669	gradient-based techniques, Probability distributions, hypotheses testing, Bayes' theorem, Maximum likelihood parameter estimation, Bayesian parameter estimation, Linear/nonlinear regression, overfitting, regularization, logistic regression, naive Bayes, k-NN, decision tree, random forest, maximum likelihood, support vector machine, Singular value decomposition, principal component analysis, clustering.	55%
2	Modeling & Simulation	ME620	Genetic Algorithm (GA), Single- and multi-layer networks,	5%

(Similarity content is declared as per the number of lecture hours on similar topics)

6. Justification of new course proposal if cumulative similarity content is >30%: Course contents matches with CS669 more than 30%. However, proposed course has been designed to focus on the applications of machine learning in Engineering. Particularly to solve problems related to Mechanical engineering, Civil engineering, and Material science. Students those have studied CS669, will not be allowed to register in ME630.

Approvals:

Faculty interested in teaching this course: – Dr. Vishal S. Chauhan, Dr. M. Talha,

Proposed by: Dr. Rajeev Kumar

School: SMME

Signature:

Date: 07/08/2024

The following faculty (at least 3 faculty) discussed on 31/10/2023 and approved the proposal on 31/10/2023.

Sl. No	Faculty Name	Signature
1.	Dr. Rajeev Kumar	
2.	Dr. Vishal S. Chauhan	
3.	Dr. M. Talha	

School Chair:

School:

Date:

This proposal is reported inthe Board of Academics on

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.



Proposal for a New Course

Course number : MT201
Course Name : Physics of Solids
Credits : 3-0-0-3
Intended for : Core for B.Tech. (MSE)
Prerequisite : None
Mutual Exclusion : None (*courses with high similarity not allowed to credit by the students after or along with this course*)

1. Preamble:

Solid-state physics is the foundation upon which modern materials science is built. It investigates how the arrangement of atoms in solids gives rise to a variety of material properties. By examining the interactions between electrons and atomic lattices, we gain insights into phenomena like conductivity, magnetism, and superconductivity. This knowledge enables the design and optimization of materials for cutting-edge applications in electronics, energy conversion, and quantum technologies. This course conveys an understanding of how solid-state physics has contributed to the existence of a number of important technological developments of importance in our lives now and in the future.

2. Course Content:

Unit 1: Crystal Structures: Elementary cell (Translation vectors, Primitive translation vectors, Bravais lattice, Basis, Crystal systems, Unit cell, and Bravais lattice types), Symmetry transformations (Axis of symmetry, Mirror planes, Point and Space symmetry groups), (Reciprocal space, Reciprocal lattice. Bragg planes, Brillouin zone, Ewald sphere Surface and Interface Physics (surface crystallography), Bragg conditions (Methods of structural studies: Laue method, rotating crystal method, powder method), Ewald construction, Lattice defects, Burger's vector. [12 Hours]

Unit 2: Transport Properties: Free Electron Theory, Fermi-Dirac distribution function, and Density of states (DoS). Energy bands in solids, electronic band structure of solids Bloch theorem and energy band, Effective mass theory, Boltzmann transport equation, Thermal and electrical conductivity (for metals, dielectrics, semiconductors), Lattice dynamics, Electron and phonon scattering, Thermal properties, the specific heat of solids, 2D electron gas, Quantum wells & semiconductor superlattices. [10 Hours]

Unit 3: Optical Properties: Drude theory-free carrier contribution to the optical properties, Absorption of light in solids, Optical properties of solids over a wide frequency range, Impurities and excitons, Luminescence and photoconductivity, Optical study of lattice vibrations, Nonlinear optics, and Electron spectroscopy and surface science. [6 Hours]



Unit 4: Magnetic Properties: Hund's law, Spin-orbit interactions, Heisenberg exchange interaction, Diamagnetism and paramagnetism, Ferromagnetism and antiferromagnetism, Curie & Neel point, Landau Diamagnetism, Magneto-resistance, Nuclear magnetic resonance (NMR), and Kondo effect. [5 Hours]

Unit 5: Superconducting Properties of Solids: Review of superconducting properties of solids, superconductivity, Meissner effect, London equation, Type I and Type II superconductors, High temperature superconducting materials, Electron orbitals, Macroscopic quantum description of the supercurrent. [8 Hours]

3. Text & References:

- H. Ibach and H. Lüth, Solid-State Physics, An Introduction to Principles of Materials Science, 4-th edition (Springer, 2009).
- C. Kittel, Introduction to Solid State Physics, 8-th edition (John Wiley & Sons, 2005).
- N. W. Ashcroft and N. D. Mermin, Solid State Physics, Brooks Cole; 1 edition (January 2, 1976).
- Solid State Physics, Essential Concepts, David W. Snoke.

Approvals:

Faculty interested in teaching this course: – Dr. Ranbir Singh, Dr. Ravindra Naik Bukke, Dr. Viswanath Balakrishnan, Dr. Sudhir Kumar Pandey

Proposed by: Dr. Ranbir Singh

School: SMME

Signature:

Date: 03.10.2024

The following faculty (at least 3) discussed on 24/09/2024 and approved the proposal on 03/10/2024.

Sl. No	Faculty Name	Signature
1.	Dr. Viswanath Balakrishnan	
2.	Dr. Ravindra Naik Bukke	
3.	Dr. Sudhir Kumar Pandey	



School Chair:

School:

[Handwritten signature]
7/10/24

Date:

This proposal is reported inthe Board of Academics on

Dean Academics

Date:



Proposal for a New Course

Course number : MT202

Course Name : Applied Quantum Mechanics

Credits : 3

Distribution : 3-0-0-3

Intended for : B.Tech.

Prerequisite : None

Mutual Exclusion: None (*courses with high similarity not allowed to credit by the students after or along with this course*)

Preamble : Quantum mechanics forms a central pillar of modern theoretical physics, while recent developments triggered interest in several areas of science and engineering, such as materials science, nanotechnology, electronic devices, and photonics. The objective of the proposed course is to introduce students to some key ideas and methods in quantum mechanics and also discuss relevant applications in the context of materials properties.

Course Outline : The course will start with a very brief review of classical mechanics and its failure at microscopic level. Then the basic features of quantum mechanics will be introduced. The course will move on to more formal and rigorous development of the quantum theory. The real-life application of the theory in understanding the various materials properties will also be considered.

Modules:

Module 1: Review of classical mechanics and its failure in understanding the behaviour of microscopic particles. Waves and particles (double-slit experiments). Introduction to the basic ideas of quantum mechanics. The postulates of quantum mechanics. Eigen-states and eigen-values of position and momentum operators. Uncertainty principle. Observables and their operators. [10 hours]

Module 2: Time independent and time dependent Schrodinger's equations. The fundamental properties of Schrodinger's equations. One-dimensional square well potential. The electron gas in a 3-dimensional box. Tunneling. The one-dimensional Harmonic oscillator. Vibration of the nuclei of a diatomic molecule. Vibration of the nuclei in a crystal. [10 hours]

Module 3: General properties of angular momentum. Commutation relations characteristic of angular momentum. General theory of angular momentum. Electron spin. Particle in a central potential. The hydrogen atom. The hydrogen atom placed in a uniform magnetic field. Paramagnetism and diamagnetism. The Zeeman effect. [10 hours]



Module 4: Stationary Perturbation theory: non degenerate and degenerate cases. A one-dimensional harmonic oscillator subjected to a perturbing potential in x , x^2 , and x^3 . The variational method. Energy bands of electrons in solids: a simple model. [6 hours]

Module 5: Quantum confinement in nanostructures, and important example problems like optical absorption in semiconductors, Experimental realization of quantum mechanics; STM, LIGO Interferometer, SQUID, nano-optomechanics, optical cavities, quantum sensor; atomic/ion trap, atomic clock etc. Brief introduction about the qubit, logic gate, Bell's inequality, entanglement, quantum interference. [6 hours]

Books:

1. Quantum Mechanics (2nd edition): Vol. 1 & 2, by Claude Cohen-Tannoudji, Bernard Diu, and Franck Laloe, Wiley-Vch (2020).
2. Principles of Quantum Mechanics (2nd edition), by R. Shankar, Plenum Press (1994).

Approvals:

Other Faculty interested in teaching this course:

Dr. Sudhir, Dr. Dube Dheeraj, Dr. Ranbir, Dr. Viswanath

Proposed by: Dr. Sudhir K. Pandey

School: SMME

Signature:

Date: 03.10.2024



The following faculty (at least 3 faculty) discussed on 24/09/2024 and approved the proposal on 03/10/2024.

Sl. No	Faculty Name	Signature
1.	Dr. Ranbir Singh	
2.	Dr. Viswanath Balakrishnan	
3.	Dr. Sudhir	

School Chair: 7/10/24

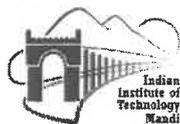
School:

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Date:



Proposal for a New Course

Course number : MT203
Course Name : Materials Synthesis & Characterization
Credit : 4
Distribution : 3-0-2-4
Intended for : B.Tech.
Prerequisite : None
Mutual Exclusion : (*Structure-Property correlation in materials for Energy Applications (EN512). This Course (with high similarity) is not allowed to be credited by the students after or along with this course.*)

1. Preamble:

The materials synthesis and characterization course will provide the fundamental concepts about materials synthesis and characterization. The course will offer different kinds of material synthesis techniques including solution-based synthesis, hydrothermal, sol-gel, and vapour phase synthesis. The students will be familiar with different characterization techniques and also the state of art facilities. This includes X-ray diffractometer (XRD), Scanning electron microscope (SEM), and Optical microscope, few spectroscopic and thermal analysis methods.

2. Course Modules with quantitative lecture hours: 32 Hours

Module-I: Introduction to the importance of materials synthesis. Describe the different synthesis methods. Describe the process of single crystal growth methods in solution. [4 Hours]

Module-II: Importance of materials characterization. Basic Crystallography; lattice, reciprocal lattice, crystal planes, and directions; Symmetry operations, point and space groups, Structure of Materials – Crystal structure, microstructure, and macrostructure; Determination of crystal structure by diffraction, X-ray diffraction, and electron and neutron diffraction; Vibrational spectroscopy (IR and Raman spectroscopy) for structural characterization of materials. [14 Hours]

Module-III: Microstructure determination by light, and electron microscopy (SEM and TEM); contrast mechanisms in imaging, binary alloys and distribution of phases in microstructure. [6 Hours]

Module-IV: Thermal analysis by TGA-DSC; Determination of enthalpy, melting, decomposition, and phase transition temperatures. [3 Hours]

Module-V: Optical properties of materials, Absorption (UV-Vis), emission (Photoluminescence), Ellipsometry for refractive index. [5 Hours]

Teaching Laboratory: 24 Hours

Experiments:

Synthesis of materials (Module-I):



1. Synthesis of materials using hydrothermal, co-precipitation, and sol-gel methods. Types of materials; a. porous ceramic materials; b. composites, c. metal oxides, and d. semiconducting materials
2. Demonstration of single crystal growth in the solution phase.

Structural Characterization (Module-II):

3. The structural characterization of developed materials using XRD. Determination of crystal structure by X-ray diffraction in a diffractometer, Crystallite size.
4. The determination of functional groups and phase identification of mentioned materials using FT-IR, and Raman spectroscopy.

Microstructural Characterization (Module-III):

5. The processing of specimen and observation of microstructure under optical microscope, scanning electron microscope.
6. The processing of specimen and observation of microstructure and electron diffraction using a transmission electron microscope.

Optical Characterization (Module-IV):

7. The processing of specimen for Absorption (UV-Vis), and emission (Photoluminescence/fluorescence) spectroscopy.

Thermal Analysis (Module-V):

8. Thermal characterization for the determination of melting, decomposition, phase transition temperatures and enthalpy.

3. Textbooks:

- Solid State Chemistry: An Introduction by L.E. Smart and E.A. (Taylor & Francis group).
- Elements of X-Ray Diffraction, B. D. Cullity
- Materials Science and Engineering by William D. Callister (Jr.)
- Solid State Chemistry and Its Applications, Anthony West (John Wiley & Sons)

4. References:

- Fundamentals of Microfabrication and Nanotechnology (Marc J.Madou)
- A. J. Moulson and J. M. Herbert, Electroceramics: Materials, Properties and Applications, Wiley; 2nd edition, 2003.
- Nanostructured Smart Materials Synthesis, Characterization, and Potential Applications, V. R. Remya (CRC Press), First Edition, 2022.
- Synthesis and Characterization of Advanced Materials, M. A. Serio, D. M. Gruen, R. Malhotra, American Chemical Society, 1997.

5. Similarity with the existing courses: (Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Course Name	Course Code	Similarity Content	Approx. % of Content
1.	Structure-Property correlation in materials for Energy Applications	EN512	I-IV	30%

6. Justification of new course proposal if cumulative similarity content is >30%:

Approvals:

Faculty interested in teaching this course: – Dr. Ravindra Naik Bukke , Dr. Neha Shukla , Dr. Viswanath Balakrishnan, Dr Swati, Dr. Jaspreet

Proposed by: Dr. Rik Rani Koner

School: SMME

Rik Koner

Signature:

Date: 03.10.2024

The following faculty (at least 3 faculty) discussed on 24/09/2024 and approved the proposal on 03/10/2024.

Sl. No	Faculty Name	Signature
1.	Dr. Ravindra Naik Bukke	<i>[Signature]</i>
2.	Dr. Neha Shukla	<i>Neha Shukla</i>
3.	Dr. Viswanath Balakrishnan	<i>[Signature]</i>

School Chair: *[Signature]*

School:

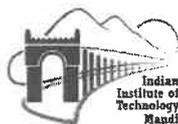
Date:

This proposal is reported inthe Board of Academics on

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.



Proposal for a New Course

Course number : MT204
Course Name : Thermodynamics and Kinetics of Materials
Credit : 3
Distribution : 3-0-0-3
Intended for : B.Tech. 3rd Year
Prerequisite : None
Mutual Exclusion : None (courses with high similarity not allowed to be credited by the students after or along with this course)

1. Preamble:

How can thermodynamic principles be applied to predict physical phenomena? Thermodynamics and kinetics of Materials course introduces you to the laws of thermodynamics and the concepts of equilibrium and thermodynamic potentials and teaches you how to apply these ideas to solve materials science and engineering problems. With an emphasis on classical thermodynamics, this course will teach you both classical and statistical interpretations of entropy, as well as the concept of constrained equilibrium, the mathematical structure of classical thermodynamics, and free energy-composition diagrams that underpin binary phase diagrams. Understand the fundamental laws of thermodynamics through the lens of materials science and engineering. Discover the molecular origins of enthalpy and entropy, describe what a thermodynamic system is and how to identify dependent and independent thermodynamic variables, construct unary and binary phase diagrams from thermodynamic principles and data, and use those to predict process outcomes and equilibrium states of the reacting system.

2. Course modules with quantitative lecture hours:

Unit-1: Introduction: Introduction to thermodynamics: enthalpy, entropy, heat capacity, specific heat, and an atomic view, Systems, states, and material properties; Processes and the First Law of Thermodynamics, Irreversible processes, the Second Law of Thermodynamics, and equilibrium, The combined statement and differential forms, equilibrium conditions, thermodynamic potentials, Helmholtz free energy, Gibbs free energy, chemical potential, thermodynamic relations, and Maxwell's relations and their applications. **(10 Hours)**

Unit-2: Free Energy Functions and their significance: Clausius-Clapeyron Equation: Derivation of Clausius-Clapeyron Equation and its Integration; Ramsay-Young, Trouton's and Duhring's rules; Fugacity, Activity and Equilibrium Constant, Numerical calculations involving equilibrium constant; Variation of equilibrium constant with temperature, integration of free-energy equation, Sigma function, Concept of Chemical Potential, and Gibbs Phase Rule. **(8 Hours)**

Unit-3: Thermodynamic solutions and Phase diagram: Thermodynamic stability of materials. Ellingham diagram and its importance, application of electrochemical series. Behavior of solutions: ideal solution, Gibb's-Duhem equation, Raoult's and Henry's law,

activity of a component, regular solutions, free energy-composition diagrams for ideal and regular solutions. Phase equilibria & phase diagram: Gibbs phase rule, isobaric phase rule and application to unary, binary, and ternary systems, eutectic and eutectoid, peritectic and peritectoid diagrams, lever rule and its application. Sievert's law: residual gases in steel-properties and functions of slags, slag compositions, structure of molten slags, molecular theory, concept of basicity index, ionic theory; thermodynamics of slag-metal reactions. (12 Hours)

Unit-4: Kinetics: Basic kinetic laws, order of reactions, rate constant, elementary and complex reactions, rate limiting steps and Arrhenius equations, theories of reaction rates-simple collision theory, activated complex theory Heterogeneous reaction; Gas-solid, solid-liquid, liquid-liquid and solid-solid systems. Empirical and Semi-empirical Kinetics, Concept of Johnson-Mehl equation, Thermal analysis. (12 Hours)

3. Text books:

1. C. H. P. Lupis: Chemical Thermodynamics of Materials, Elsevier Science, 1982
2. Gaskell, D.R., Introduction to Metallurgical Thermodynamics, 3rd Ed., McGraw-Hill. 1995
3. Ghosh A., Textbook of Materials and Metallurgical Thermodynamics, Prentice Hall of India, 2003.
4. Balluffi R.W., Allen S.M. and Carter W.C., Kinetics of Materials, John Wiley & Sons. 2005
5. Upadhyaya G.S. and Dube R.K., Problems in Metallurgical Thermodynamics and Kinetics, Pergamon Press, 1985.

4. References:

1. Text Book of Materials and Metallurgical Thermodynamics, Ahindra Ghosh, Prentice Hall of India Pvt. Ltd., 2003.
2. Tupkary R.H., 'Introduction to Metallurgical Thermodynamics', 1st Edition, TUPublishers, 1995.

5. Similarity with the existing courses: NA

(Similarity content is declared as per the number of lecture hours on similar topics)

6. Justification of new course proposal if cumulative similarity content is >30%:

NA

Approvals:

Other Faculty interested in teaching this course: –

Prof. Rahul Vaish, Dr. Rik Rani Koner, Dr. Sandeep Sahu, Dr. Neha Shukla, Dr. Suntharavel M

Proposed by: Dr.V.M.Suntharavel Muthaiah

School: SMME

Signature:

V.M. Sunthar

Date: 03.10.2024

The following faculty (at least 3) discussed the proposal on 24/09/2024 and approved it on 03/10/2024.

Sl. No	Faculty Name	Signature
1.	Dr. Viswanath Balakrishnan	3 Rik
2.	Dr.Neha Shukla	Neha Shukla
3.	Dr. Rik Rani Koner	Rik Koner

School Chair:

11/10/24

School:

Date:

This proposal is reported inthe Board of Academics on

Dean Academics

Date:

Note: School is responsible for the Course Code. The Academic Office provides the IC Course Code.



Proposal for a New Course

Course number : MT205
Course Name : Functional Properties of Materials
Credit : 4
Distribution : 3-0-2-4
Intended for : Core for B.Tech. (MSE)
Prerequisite : None
Mutual Exclusion : EN509: Functional Materials for Energy Engineering (*This course with high similarity not allowed to credit by the students after or along with this course*)

1. Preamble:

This course is designed for students from diverse fields, providing a comprehensive understanding of the intrinsic and extrinsic properties that enable materials to perform specific functions across various applications. It offers a solid conceptual background in material science & solid-state physics, bridging the gap between fundamental concepts and practical device applications. By exploring how electronic, magnetic, optical, thermal, and mechanical properties arise from a material structure-property correlation, students will learn to tailor these functionalities for advanced technologies in energy, electronics, and sensing.

2. Course Content:

Unit 1: Introduction: Overview of functional materials, including inorganic, organic, and metal-organic frameworks, as well as hybrid organic-inorganic perovskites. Discussion on the use of material functionalities in device fabrication. Exploration of functionalities driven by electronic, spin, and ionic properties, along with the integration of these effects for designing novel materials. [4 Hours]

Unit 2: Functionality Driven by Electronic Properties: Examination of amorphous and crystalline solids, electronic states, band formation, and band dispersions in crystalline materials. Coverage of metals, semiconductors, and insulators, including direct and indirect bandgap semiconductors, impurity bands in doped semiconductors, charge carrier transport, and optical properties, with a focus on optoelectronic materials. [12 Hours]

Unit 3: Functionality Driven by Spin Properties: Exploration of magnetic moments in atoms, spin and orbital contributions in solids, magnetization, and various types of magnetic materials and their applications. Detailed discussion on exchange interactions, magnetic transition temperatures (mean-field theory), domain wall formation, and materials like Magnetoresistance, CMR/GMR. [10 Hours]

Unit 4: Functionality Driven by Ionic Properties: Investigation of covalent, ionic, and metallic solids, dipole formation, and polarization. Overview of paraelectric, ferroelectric, antiferroelectric, piezoelectric, and pyroelectric materials, including domain wall formation in ferroelectrics and multiferroic materials. [6 Hours]



Unit 5: Functional Devices Driven by Functionality: Study of functional devices such as light-emitting diodes, solar cells, quantum devices, FETs, Memristors, MOS Capacitors, photodetectors, thermoelectric, and photovoltaic devices, showcasing the practical application of functional materials. [10 Hours]

Teaching Laboratory:

Experiments:

1. Crystal structures (Utilizing 3D models to understand crystal structures and understand lattice, packing fraction, mass, density, concept of Avogadro Number, etc.).
2. Optical properties characterization using absorption/photoluminescence spectroscopy.
3. Evaluate the electrical conductivity of materials through experiments such as four-point probe measurements.
4. Magnetic /Piezoelectric materials; measurement of M-H and P-E hysteresis loops.
5. Thermal Analysis: Perform experiments to measure thermal properties like thermal conductivity, TGA-DSC, specific heat, and thermal expansion of different materials.
6. Superconductivity and its phenomena. Demonstrating the Meissner effect and examining persistent currents.
7. Design and development of power packs with supercapacitors.
8. Characterizations of optoelectronic devices such as solar cells, photodetectors, and phototransistors. Analyse the effects of varying light intensity on power output of solar cells, current-voltage characteristics/ detectivity & sensitivity of the photodetector.

3. Textbooks:

- Solid State Physics by N. W. Ashcroft and N.D. Mermin, 1976, Harcourt College Publishers
- The Physics of Semiconductors: An Introduction Including Devices and Nanophysics by Marius Grundmann, 2010, Springer Berlin Heidelberg New York
- Principles of Materials Science and Engineering, W.F. Smith, McGraw-Hill.
- Engineering Materials and Their Applications, R.A. Flinn and P.K. Trojan, Haughton.
- Neil W. Ashcroft and N. David Mermin, Solid State Physics, Saunders College Publishing, 1976

4. References:

- Electronic Structure: Basic Theory and Practical Methods by R. M. Martin, 2004, Cambridge University Press.
- Multiferroicity: The coupling between magnetic and polarization orders by K.F. Wang, J. – M. Liu, and Z. F. Ren, Advances in Physics 58, 321 (2009).
- Principles of Electronic Materials and Devices by S. O. Kasap

5. Similarity with the existing courses: (Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Course Name	Course Code	Similarity Content	Approx. % of Content



1.	Functional Materials for Energy Engineering	EN 509	1-2	40%
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6. Justification of new course proposal if cumulative similarity content is >30%:

The course EN509 (Theory) is modified into MT205 (Theory and Lab) to cater the basics of the Materials and Energy Engineering program. The modifications are brought in two areas.

1. The name is changed from Functional Materials for Energy Engineering to Functional Properties of Materials.
2. The last module is changed from earlier EN 509 to provide a detailed and conceptual outlook of energy engineering devices and their applications. This course will act as the core course (theory and Lab) for undergraduate students and hence this modification was mandatory, especially to look after the students from varying backgrounds.

Approvals:

Faculty interested in teaching this course: – Dr. Ranbir Singh, Dr. Viswanath Balakrishnan, Dr. Sudhir, Dr. Ravindra, Dr. Rik Rani, Dr. Neha, Dr. Jaspreet

Proposed by: Dr. Ranbir Singh

School: SMME

Signature:

Date: 03.10.2024

The following faculty (at least 3 faculty) discussed on 24/09/2024 and approved the proposal on 03/10/2024.

Sl. No	Faculty Name	Signature
1.	Dr. Ranbir Singh	
2.	Dr. Viswanath Balakrishnan	
3.	Dr. Sudhir	



School Chair:

7/10/24

School:

Date:

This proposal is reported inthe Board of Academics on

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Date:



Proposal for a New Course

Course number	: MT206
Course Name	: Extraction and Materials Processing
Credit	: 4
Distribution	: 3-0-2-4
Intended for	: B.Tech.
Prerequisite	: None
Mutual Exclusion	: None (<i>courses with high similarity not allowed to credit by the students after or along with this course</i>)

1. Preamble:

Extraction and materials processing play a pivotal role in transforming raw resources into valuable products and are fundamental processes in various agriculture and manufacturing industries. These processes involve removing, separating, and refining of materials to meet specific quality, purity, or functional requirements. The efficient and sustainable management of extraction and materials processing is essential for economic growth, environmental conservation, and technological advancement. Finally, to sets the stage for exploring the intricate world of extracting and processing materials, highlighting their significance in shaping our modern world.

2. Course Modules

Module I: Introduction to extraction and materials processing [5 hours]

Define extraction and material processing, processing methods for different types of materials (Meals, Ceramics, Glass, Polymers, and Composites), the significance of these processes in various industries, including urban mining (waste material management), the importance of sustainable sourcing and responsible extraction practices. Discuss standard processing techniques such as crushing, grinding, smelting, refining, and sorting. Environmental and social impacts of extraction methods.

Module II: Heat treatment [5 hours]

Annealing, normalizing, hardenability, hardening, tempering, mechanism of heat removal during quenching, quenching media, residual stresses and quench cracks, martempering and austempering, alloying, effect of alloying on Fe-Fe₃C phase diagram, sintering, and spark plasma sintering.

Module III: Electrolysis [2 hours]



Electroplating, electrorefining, extraction, purification, and standard electrode potential (SEP) of metals and metal ions.

Module IV: Grinding/Polishing [5 hours]

Abrasion, classification of abrasive, principles, factors determining grinding/polishing, grinding (ball milling, mechanical alloying, mechanochemical processing). Wet and dry grinding, chemical comminution-leaching, dissolution, screening, crushing and sizing of comminuted particles, concentration techniques: gravity concentration, magnetic and electrostatic separation, froth floatation factors affecting rate of screening.

Module V: Thin film deposition: [8 hours]

Definition and significance of thin films, thin film growth techniques (CVD, thermal evaporation, sputtering, and solution process), applications of thin films (semiconductor device fabrication, optoelectronic devices, e.g., solar cells, LEDs, OLEDs, and coatings for corrosion protection & wear resistance.), and lithography.

Module VI: Laser Processing [5 hours]

Introduction to laser processing, basics of laser technology, significance and applications in industry, direct patterning, laser cutting, laser welding, emerging trends in laser processing (e.g., Ultrafast laser processing, laser-assisted material synthesis laser micropatterning and nanostructuring)

3. Teaching Laboratory/Practical Objectives:

- a. Heat treatment: To study the material at extremely high temperatures using the muffle furnace and tube furnace. **[3 hours]**
- b. To study the advanced processing methods (Spark plasma sintering and glass processing), **[3 hours]**
- c. To study the fine finishes or light cuts on metals and other materials (grinding). **[3 hours]**
- d. To study the extraction and purification of metals from raw materials. **[3 hours]**
- e. To study electroplating, electro-refining, and the standard electrode potential (SEP) of metals/metal ions. **[3 hours]**



f. To study the process of creating a smooth and shiny surface by rubbing it or applying a chemical treatment (Polishing). [3 hours]

g. Thin film deposition:

i. Thin film coating using a solution process (e.g., spin coater) [3 hours]

ii. Thin film coating using a vacuum process (e.g., sputtering) [3 hours]

h. Laser lithography: To study the modification of the shape or appearance of a material. Micro-scale pattern development. [3 hours]

4. Textbooks & References

1. Heat Treatment: Principles and Techniques by T.V. Rajan, C.P. Sharma, Ashok Rajan, PHI Learning.

2. Fundamentals of Materials Science and Engineering by William D. Callister, Jr., David G. Rethwisch, John Wiley & Sons

3. The Extraction and Refining of Metals (Materials Science & Technology) 1st Edition by Colin Bodsworth & Brian Ralph

4. Materials Science and Engineering by William F. Smith, Tata McGraw-Hill Education.

5. Free M., Moats M., Houlachi G., Asselin E., Allanore A., Yurko J., Wang S (2012) Electrometallurgy 2012, John Wiley & Sons, Inc., Hoboken, New Jersey.

5. Similarity with the existing courses:

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Course Code	Similarity Content	Approx. % of Content

6. Justification of new course proposal if cumulative similarity content is >30%: NA



Approvals:

Faculty interested in teaching this course: Dr. Neha Shukla, Dr. Viswanath Balakrishnan, and Dr. Rik Rani Koner, Dr. Ravindra Naik Bukke,, Dr. Suntharavel M, Dr. Sandeep Sahu, Dr. Swati Sharma

Proposed by: Dr. Ravindra Naik Bukke

School: SMME

Signature

Date: 03.10.2024

The following faculty (at least 3) discussed the proposal on 24/09/2024 and approved it on 03/10/2024.

Sl. No	Faculty Name	Signature
1.	Dr. Ravindra Naik Bukke	
2.	Dr. Neha Shukla	
3.	Dr. Viswanath Balakrishna	

School Chair:

7/10/24

School:

Date:

This proposal is reported inthe Board of Academics on

Dean Academics

Date:

Note: School is responsible for the Course Code. The Academic Office provides the IC Course Code.



Proposal for a New Course

Course number : MT301
Course Name : Phase Transformations
Credit : 3
Distribution : 3-0-0-3
Intended for : Core for B.Tech. (MSE)
Prerequisite : None
Mutual Exclusion : None (*courses with high similarity not allowed to credit by the students after or along with this course*)

1. Preamble:

The course on phase transformations with emphasis on solid state provides fundamental knowledge of materials with respect to different conditions and processing. Some of the targeted learning objectives include thermodynamic aspects of phase changes, interpretation of free energy diagrams and origin of phase diagrams, atomic mechanism of diffusion, analyze diffusion mechanism in different kinds of solid solutions, mathematical expressions of diffusion in order to interpret industrial processes such as carburizing, homogenizing, solidification, Solid state phase transformations in steel and other important engineering materials.

2. Course Modules with quantitative lecture hours:

Unit-1:

Overview of phase transformations, phase equilibria, thermodynamics of phase changes, free energy, order of transformation, thermodynamic driving force; nucleation and growth theories, homogeneous and heterogeneous nucleation, growth kinetics, precipitation and phase separation - spinodal microstructures, crystal interfaces and microstructure. **(6 Hours)**

Unit-2:

Eutectic and peritectic transformation, heat-treatment of ferrous and nonferrous metals, eutectoid, phase diagrams and equilibria in relation to free energy-composition diagrams. interpretation of phase diagrams, determination and calculations, solid-liquid miscibility gap; invariant reaction. Principles of ternary phase diagram, examples of a few metallic and ceramic phase diagrams. **(12 Hours)**

Unit-3:

Principles of Solidification in metals and alloys: thermodynamics involved, eutectic and peritectic Solidification, Homogeneous and heterogeneous nucleation, Mechanisms of growth. Rapid Solidification Processing. Austenite, transformation of austenite, TTT diagram, eutectoid transformation, pearlite and bainite transformation, order-disorder transformation, precipitation hardening, spinodal decomposition and massive transformation, solidification. **(8 Hours)**

Unit-4: Martensite transformation: characteristics and nature, morphology, crystallography, theory of nucleation and growth, and pre-martensite phenomena, martensitic transformation

in steel. Martensite in non-Ferrous systems-thermoelastic martensite and shape memory effect (8 Hours)

Module-V: Applications (4 Hours)

Smart materials and actuators, shape memory effect, metal-insulator transition.

3. Text books:

1. Phase transformations in metals and alloys- D.A. Potter and K.E. Easterling, CRC Press,1992.
2. Transformations in Metals, P.G. Shewmon, Mc-Graw Hill, 1969.
3. Introduction to Physical Metallurgy – S. N. Avner, Tata McGraw Hill, 1997.
4. Physical Metallurgy – Peter Haasen, Cambridge University Press, 1996.

4. References:

6. Physical Metallurgy for Engineers – A. G. Guy, Addison-Wesley Pub. Co., 1962.
7. Modern Physical Metallurgy, R. E. Smallman, Butterworths, 1963.

5. Similarity with the existing courses: NA

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Course Name	Course Code	Similarity Content	Approx. % of Content
1.				
2.				

6. Justification of new course proposal if cumulative similarity content is >30%:

This course is specifically designed for B.Tech. Materials Engineering as core course.

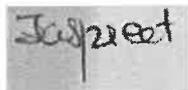
Approvals:

Faculty interested in teaching this course: –

Dr. Sandeep Sahu, Dr. Suntharavel Muthaiah, Dr. Viswanath Balakrishnan, Dr. Rik Rani Koner,

Proposed by: Dr Jaspreet Randhawa

School: SMME



Signature:

Date: 03/10/2024

The following faculty (at least 3) discussed on 24/10/2024 and approved the proposal on 03/10/2024.

Sl. No	Faculty Name	Signature
1.	Dr. Rik Rani Koner	<i>Rik koner</i>
2.	Dr. Suntharavel VM	<i>V. S. Sunthar</i>
3.	Dr. Viswanath B	<i>B. Viswanath</i>

School Chair: *7/10/24*

School:

Date:

This proposal is reported inthe Board of Academics on

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

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Proposal for a New Course

Course number : MT302
Course Name : Transport Phenomena
Credit : 3
Distribution : 3-0-0-3
Intended for : B.Tech.
Prerequisite : None
Mutual Exclusion : None (*courses with high similarity not allowed to credit by the students after or along with this course*)

1. Preamble:

The aim of this course is to encompass the principles of heat, mass, and energy transfer, which play a fundamental role in a wide range of scientific and engineering disciplines. This course explores essential mechanisms that govern these processes, with a special focus on their applications in electrical conductivity, thermal management, and material behaviour across different domains, such as semiconductors, metals, and fluids. By integrating theoretical knowledge with practical examples, this course aims to equip students with the foundational understanding necessary to analyse and design systems in advanced materials, energy applications, electronics, and other interdisciplinary fields.

2. Course modules with quantitative lecture hours:

Unit-1: Introduction Transport phenomena are vital for understanding the electrical conductivity of metals, semiconductors, and various other fields. Focus on the transport of heat, energy, and mass on a macroscopic scale. Ellipsoidal carrier pockets. Electrons and holes in intrinsic semiconductors. Donor and acceptor doping of semiconductors. characterization of semiconductors. **(2 Hours)**

Unit-2: Thermal Transport. Thermal conductivity for metals, semiconductors, and insulators. Thermoelectric phenomena in metals. Thermopower for semiconductors. Effect of Thermoelectricity on the thermal conductivity. Thermoelectric measurements. Seebeck Effect (Thermopower). Peltier effect. Thomson effect. The kelvin relations. Phonon drag effect. Electron and Phonon Scattering, Scattering processes in semiconductors. Electron-phonon scattering. ionized impurity scattering. Temperature dependence of the electrical and thermal conductivity. Liouville's equation, Boltzmann equation, carrier scattering, Classical Laws and conservation equations, phonon hydrodynamic equation. **(12 Hours)**

Unit-3: Energy Transport: Fourier's law and thermal conductivity of materials, gases, solids, liquids and bulk materials. **Heat transfer with forced convection** in a tube, flat plate, natural convection and the energy equation. **Conduction heat transfer:** Conduction of heat in solids, the energy equation for conduction, Steady-state one-dimensional systems, Transient systems, finite dimensions, Transient conditions, infinite and semi-infinite solids, Simple multidimensional, Moving sources. **Radiation heat transfer:** Concept of black body and emissivity, radiation view factors. The energy distribution and the emissive power. Gray bodies and absorptivity, Exchange between infinite parallel plates. Radiation combined with

convection. Radiation from gases, transparent solids. Transient conduction with radiation at the surface. Transient heating with thermal stresses. (12 Hours)

Unit-4: Mass Transport: Interphase mass transfer, Definition of fluxes-Fick's first law, Diffusion in solids, Diffusion in ceramic materials, Diffusion in elemental semiconductors, Diffusion in liquids, Diffusion in gases, Diffusion through porous media. Diffusion in solids, Steady-state diffusion experiments. Transient diffusion experiments. Finite system solutions. Microelectronic diffusion processing. Homogenization of alloys. Formation of surface layers. **Mass transfer in fluid systems** Diffusion through a stagnant gas film. Diffusion in a moving gas stream. Diffusion into a falling liquid film. The mass transfer coefficient. General equation of diffusion with convection. Mass transfer with forced convection over a flat plate. (10Hours)

Unit-5: Coupled Fluids with Heat and Mass Transfer: Coupled fluids, heat and mass transfer, heat and mass transfer coefficients, natural convection (4 Hours)

Unit-6: Applications of transport phenomena: Cooling devices, microfluidics devices, thermoelectric materials, semiconductor/solid-state devices, electrochemical devices, food industry, biomedical. (2 Hours)

3. Text books:

1. Gaskell, David R. "An Introduction to Transport Phenomenon in Materials Engineering," 2nd edition, Momentum Press.
2. Bird, R. Byron, W. E. Stewart, and E. N. Lightfoot. "Transport Phenomena (4th edn)." (2006).
3. Thomson, William J. Introduction to transport phenomena. 2000.
4. Robert S., and Harry C. Hershey. Transport phenomena: a unified approach. Brodkey Publishing, 2003.

4. References:

1. C. J. Geankoplis, Transport Processes and Separation Process Principles, Prentice-Hall Inc., 4th Edition 2003.
2. C. O. Bennett, J. O. Myers, Momentum, Heat, and Mass Transfer, 2nd International Student Edition, McGraw Hill, 1983.

5. Similarity with the existing courses:

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.		Course Code	Similarity Content	Approx. % of Content
1.	Heat Transfer	ME303	Basics of heat conduction and radiation	10%

6. Justification of new course proposal if cumulative similarity content is >30%:

This course is specifically designed for a B.Tech. Materials Engineering course for the unified treatment of mass, momentum, and heat transport. Since Materials Engineering doesn't demand intensive and individual courses on these subjects, a cumulatively well-balanced course is proposed for Material Engineering students.

Approvals:

Other Faculty interested in teaching this course: Dr. Sarthak Nag, Dr. Suntharavel and Prof. Rahul Vaish, Dr. Viswanath Balakrishnan , Dr. Sudhir Kumar Pandey

Proposed by: Dr. Suntharavel V.M

School: SMME

V. M. Suntharavel

Signature:

Date: 03.10.2024

The following faculty (at least 3) discussed on 24/09/2024 and approved the proposal on 03/10/2024.

Sl. No	Faculty Name	Signature
01	Dr. Viswanath Balakrishnan	<i>3 RA</i>
02	Dr. Sudhir Kumar Pandey	<i>Sundey</i>
03	Dr. Suntharavel V.M	<i>V. M. Suntharavel</i>

School Chair:

[Signature]
11/10/24

School:

Date:

This proposal is reported inthe Board of Academics on

Dean Academics

Date:



Proposal for a New Course

Course number : MT303
Course Name : Computational Materials Science
Credit : 4
Distribution : 3-0-2-4
Intended for : B.Tech.
Prerequisite : None
Mutual Exclusion: None (*courses with high similarity not allowed to credit by the students after or along with this course*)

1. Preamble:

This course in Computational Materials Science delves into the theory and application of atomic-scale computational tools, enabling students to model, understand, and predict the properties of real materials. Emphasizing a practical approach, the course covers quantum-mechanical electronic structure methods, classical force fields, molecular dynamics, and Monte Carlo simulations. Through hands-on laboratories, students will gain extensive experience with cutting-edge materials modelling codes, bridging the gap between theoretical knowledge and practical application.

2. Course Modules with quantitative lecture hours:

Module-I: Introduction: Definition and scope of Computational Materials Science; Overview of computational methods: Quantum Mechanics, Molecular Dynamics, Monte Carlo simulations; Role of computational tools in materials discovery and design; Hands-on session introducing materials modeling codes [4 Hours]

Module-II: Quantum Mechanical Methods for Materials Simulation: Basics of quantum mechanics applied to materials science; Density Functional Theory (DFT) and its practical applications; Quantum Monte Carlo methods and their role in materials simulations; Practical exercises using materials modeling codes for electronic structure calculations [10 Hours]

Module-III: Classical Methods for Materials Simulation: Molecular Dynamics simulations: principles and applications; Monte Carlo simulations in materials science: theory and practice; Introduction to classical force fields; Application of classical methods in predicting material behavior [8 Hours]

Module-IV: Electronic Structure Calculations : Band structure calculations and their interpretation; Electronic density of states and its significance; Tight-binding and empirical methods

for electronic structure predictions; Hands-on application of computational tools for electronic structure analysis [**12 Hours**]

Module-V: Materials Design and Optimization: Rational design of materials using computational methods; Optimization algorithms and their role in materials science; High-throughput screening for material discovery; Case studies on computationally designed materials [**6 Hours**]

Module-VI: Advanced Topics in Computational Materials Science: Quantum transport simulations for materials applications; Computational studies of surfaces and interfaces; Machine learning applications in materials science; Future directions and challenges in the field [**10 Hours**]

**Teaching Laboratory:
Experiments:**

- 1) Introduction to computational software for materials science simulations.
- 2) Quantum mechanical simulations using DFT software.
- 3) Molecular Dynamics simulations for understanding material behavior.
- 4) Electronic structure calculations and visualization.
- 5) Materials design and optimization using computational tools.
- 6) Hands-on session on machine learning applications in materials science.

3. Textbooks:

- Introduction to Computational Materials Science by Richard LeSar
- Computational Materials Science: An Introduction by June Gunn Lee
- Computational Materials Engineering: An Introduction to Microstructure Evolution by Koenraad George Frans Janssens
- Electronic Structure: Basic Theory and Practical Methods by Richard M. Martin
- Molecular Modeling of Inorganic Compounds by Peter Comba
- Density Functional Theory: A Practical Introduction by David Sholl and Janice A. Steckel
- Machine Learning in Materials Science by Keith T. Butler, Felipe Oviedo, Pieremanuele Canepa

Approvals:

Faculty interested in teaching this course: – Dr. Ranbir Singh, Dr. Sudhir, Dr. Dheeraj Dube P

Proposed by: Dr. Dheeraj Dube P

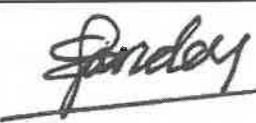
School: SMME

Signature:

D. Dube

Date: 03.10.2024

The following faculty (at least 3) discussed on 24/09/2024 and approved the proposal on 03/10/2024.

Sl. No	Faculty Name	Signature
1.	Dr. Ranbir Singh	
2.	Dr. Dheeraj Dube P	<i>D. Dube</i>
3.	Dr. Sudhir	

School Chair:


7/10/24

School:

Date:

This proposal is reported inthe Board of Academics on

Dean Academics

Date:



Proposal for a New Course

Course number : MT304
Course Name : Mechanical Behavior of Materials
Credit : 4
Distribution : 3-0-2-4
Intended for : B.Tech.
Prerequisite : None
Mutual Exclusion: EN611-Durability Behavior of Energy Materials (Specify the equivalent courses in other schools. These *Courses (with high similarity) are not allowed to credit by the students after or along with this course.*)

Preamble: The course examines the durability behavior of materials employed in various engineering applications. The challenge to durability comes from the deformation at room and elevated temperature under static and dynamic loading prevailing under a given application circumstance. In addition, corrosion, wear, and erosion limit the life of components. The course offers a holistic view of durability, indicating the directions of materials development for structural, thermal, and energy applications.

Course Outline: The course will start with a test of deformation behavior to identify the material parameters governing durability under static load and then proceed to understand the instantaneous deformation behavior under static and dynamic loading and after that, focuses on high-temperature time-dependent deformation behavior prevalent in high-temperature to follow the development of alloys for ultra-supercritical boilers and turbines. At the end the course focuses on durability threats to components employed in energy generation from corrosion, hot corrosion, erosion, and cavitation, as well as the strategies to counter them. The course will be delivered in the following modules.

Module 1: Static loading and Deformation behavior Distinctive load – elongation behavior of different types of materials under uni-axial loading, definition of stress and strain, stress-strain diagram, elastic behavior, yielding and plastic behavior of ductile materials; necking instability, Important design criteria based on stress and strain at ambient temperature; strain rate and its influence of stress-strain diagram at elevated temperature. [4 Hours]

Module 2: Durability under static loading Defects in materials; linear defects or dislocations – types, burgers vector, slip, slip planes and slip directions, cross slip and climb, movement of dislocations leading to plastic deformation, stacking fault and partial dislocations, strain hardening, grain boundaries, strengthening mechanisms; recovery, recrystallization and grain growth during heating of deformed materials. [4 Hours]

Module 3: Durability under Creep Deformation, Deformation under static loading at elevated temperature - creep curve, mechanisms of creep, the temperature dependence of creep, deformation mechanism maps, cavitations, stress rupture versus creep, extrapolation schemes; Development of materials for ultra-supercritical boilers for application in furnace panels, super-heaters, thick section components, and steam lines. [4 Hours]

Module 4: Durability under Cyclic Loading, Deformation under cyclic loading, high cycle fatigue – S-N curve, effect of mean stress, Miner rule, cyclic stress-strain curve, low cycle fatigue, strain life equation, effect of stress concentration and size of component, Design for fatigue, effect of temperature on fatigue; creep-fatigue interaction, development of turbine materials. [4 Hours]

Teaching Laboratory:

Experiments:

1. Tensile test on ferrous materials

Determine mechanical properties (yield stress, ultimate stress, breaking stress, percentage of reduction in area, percentage of elongation, and Young's modulus) for ferrous materials.

2. Tensile test on non-ferrous materials

Compare the stress-strain diagrams of non-ferrous materials with those of ferrous materials.

3. Compression test on brittle vs. ductile metallic materials

Analyze the mechanical properties of both brittle and ductile materials under compression.

4. Compression test on ceramic materials

Determine the mechanical properties of ceramic materials through compression testing.

5. Microstructure examination

Study and compare the grain structures in various metallic and non-metallic materials using optical or electron microscopy.

6. Creep test

Conduct a creep test to observe the time-dependent deformation behavior of a selected material under constant stress.

7. Stress corrosion cracking study

Investigate the effects of stress corrosion cracking in specific materials by applying tensile stress in a corrosive environment.

8. Hydrogen embrittlement study

Analyze the effects of hydrogen embrittlement on selected metallic specimens by subjecting them to hydrogen exposure.

9. Micro-hardness/nanoindentation test

Perform hardness tests on various materials using micro-hardness or nanoindentation techniques to assess material properties at small scales.

10. Fatigue test

Conduct fatigue tests on selected materials to evaluate their resistance to cyclic loading and determine fatigue life.

11. Impact resistance and hardness measurement

Measure the hardness and impact resistance of various samples to assess their toughness and durability.

12. Friction and wear study

Investigate the frictional behavior of different material combinations under varying loads, sliding speeds, temperatures, and lubrication conditions to predict the coefficient of friction and wear rates.

Text Books:

1. George E. Dieter, Mechanical Metallurgy, McGraw Hill Book Company 1986

References:

1. Meyers, M.A. and Chawla, K.K., Mechanical Behavior of Materials, 2nd edition, Prentice Hall, 2008.

Similarity with the existing courses: (Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Course Name	Course Code	Similarity Content	Approx. % of Content
1.	Durability Behavior of Energy Materials	EN611	Same content between the two courses	100%

Justification of new course proposal if cumulative similarity content is >30%:

The course EN611 (**Durability Behavior of Energy Materials**) is currently being offered in SMME, only to PG and PhD students. The proposed course, MT304 - **Mechanical Behavior of Materials**, is for **B.Tech students** and covers similar topics at a level suited for undergraduates. While the content overlaps, the **focus and depth** will be adjusted for B.Tech students, emphasizing practical understanding rather than advanced analysis. Thus, despite the content similarity, the difference in **target audience and objectives** justifies the new course.

Approvals:

Faculty interested in teaching this course: –

Dr. Sandeep Sahu, Dr.V.M.Suntharavel Muthaiah, Dr. Visshal, Dr. Rahul Vaish, Dr. Sudhir Pandey, Dr. Jaspreet, Dr. Rik Koner, Dr. Swati, Dr. Ravindra, Dr. Neha Shukla

Proposed by: Dr. Sandeep Sahu

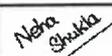
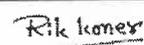
School: SMME

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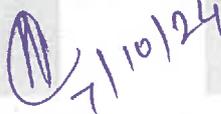


Date: 03/10/2024

The following faculty (at least 3) discussed the proposal on 24/09/2024 and approved it on 03/10/2024.

Sl. No	Faculty Name	Signature
1.	Dr. Viswanath Balakrishnan	
2.	Dr.Neha Shukla	
3.	Dr. Rik Rani Koner	

School Chair:



School:

Date:

This proposal is reported in the Board of Academics on

Dean Academics

Date:

Note: School is responsible for the Course Code. The Academic Office provides the IC Course Code.



Proposal for a New Course

Course number : MT501
Course Name : Energy Conversion & Storage Technology
Credit : 3-0-0-3
Intended for : B.Tech./M.Tech./M.Sc./Ph.D.
Prerequisite : None
Mutual Exclusion : EN-503. This *Course (with high similarity) is not allowed to credit by the students after or along with this course.*

1. Preamble:

Emerging energy conversion and storage devices play a pivotal role in efficiently harnessing, storing, and delivering energy from renewable sources. This course provides a comprehensive understanding of the fundamental principles and advanced technologies involved in converting energy from various sources into usable forms and storing it efficiently. This course will explore diverse methods of energy conversion, including thermodynamic, electrochemical, mechanical, and photovoltaic processes, while also exploring innovative storage solutions designed to enhance energy efficiency and sustainability in next-generation batteries and fuel cells.

Course Content:

Unit 1: Energy conversion & storage systems overview: Scope of energy storage & conversion, needs and opportunities in energy storage, Overview of key technologies and interdisciplinary aspects, with a focus on comparing the time scales of various storage methods and their application, Energy storage in the power and transportation sectors. Importance of energy conversion systems in the development and performance of electric vehicles. (5 Hours)

Unit 2: Energy Conversion Systems: Energy conversion systems transform various forms of energy—such as mechanical, thermal, chemical, or solar—into electrical energy. (6 Hours)

Unit 3: Chemical Energy Storage Systems: Chemical storage system- hydrogen, methane, etc., concept of chemical storage, advantages and limitations, challenges, and future prospects of chemical storage systems. (5 Hours)

Unit 4: Thermal Storage Systems: thermal storage systems such as heat pumps, hot water storage tanks, and solar thermal collectors. Examine the application of phase change materials (organic and inorganic) for heat storage, along with system efficiencies and economic assessments. (6 Hours)

Unit 5: Electromagnetic Energy Storage Systems: Electromagnetic storage systems, including double-layer capacitors for electrostatic charge storage and superconducting magnetic energy storage (SMES). Analyze the concepts, advantages, limitations, and future prospects of these systems. (5 Hours)

Unit 6: Electrochemical storage and conversion systems:

- a) **Batteries-**Working principle of battery, primary and secondary (flow) batteries, battery performance evaluation methods, major battery chemistries and their voltages- Li-ion battery & Metal hydride battery vs lead-acid battery, metal-air battery. (6 Hours)



- b) **Supercapacitors-** Working principle of supercapacitor, types of supercapacitors, cycling and performance characteristics, difference between battery and supercapacitors, Introduction to Hybrid electrochemical supercapacitors (6 Hours)
- c) **Fuel cell:** Operational principle of a fuel cell, types of fuel cells, hybrid fuel cell-battery systems, hybrid fuel cell-supercapacitor systems. (3 Hours)
- d) **Water electrolysis for hydrogen generation:** Cell technologies, Gibbs Free energy of the water splitting reaction and cell voltage, Current-Voltage relationships, Degradation mechanisms. (3 Hours)

Unit 7: Battery design for transportation: Mechanical design and packaging of battery packs for electric vehicles, advanced quick charging methods, thermal management, state of charge and state of health estimation, and the recycling of batteries used in electric vehicles. (4 Hours)

2. Text books:

- Frank S. Barnes and Jonah G. Levine, Large Energy Storage Systems Handbook (Mechanical and Aerospace Engineering Series), CRC press (2011)
- Ralph Zito, Energy storage: A new approach, Wiley (2010)

4. Reference:

- Pistoia, Gianfranco, and Boryann Liaw. Behaviour of Lithium-Ion Batteries in Electric Vehicles: Battery Health, Performance, Safety, and Cost. Springer International Publishing AG, 2018.
- Robert A. Huggins, Energy storage, Springer Science & Business Media (2010)

5. Similarity with the existing courses: (Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Course Name	Course Code	Similarity Content	Approx. % of Content
1.	Energy storage technologies	EN-503	Partly updated	40%

Justification of new course proposal if cumulative similarity content is >30%: The advanced energy conversion part has been included in this course. The course code (title) has been changed from EN503 (Energy storage technologies) to MT501(Energy Conversion & Storage Technology). Cumulatively well balanced course (MT501) is proposed for MSE students.



Approvals:

Faculty interested in teaching this course: – Dr. Rik Rani Koner, Dr. Ranbir Singh, Dr. Swati Sharma, Dr. Viswanath Balakrishnan , Dr. Neha Shukla

Proposed by: Dr. Rik Rani Koner

School: SMME

Rik Koner

Signature:

Date: 03/10/2024

The following faculty (at least 3) discussed on 24/09/2024 and approved the proposal on 03/10/2024.

Sl. No	Faculty Name	Signature
1.	Dr. Rik Rani	<i>Rik Koner</i>
2.	Dr. Ranbir Singh	<i>Ranbir Singh</i>
3.	Dr. Swati	<i>Swati</i>

School Chair:

[Signature] 7/10/24

School:

Date:

This proposal is reported in the Board of Academics on

Dean Academics

Date:



Proposal for a New Course

Course number : MT502
Course Name : Recycling and Circular Economy
Credit : 3
Distribution : 3-0-0-3
Intended for : B.Tech/PG/Ph.D.
Prerequisite : None
Mutual Exclusion : None (*courses with high similarity not allowed to credit by the students after or along with this course*)

1. Preamble:

The course provides an insight into modern recycling routes for recovering valuable metals and materials from metallurgical and electronic wastes. The fundamentals of recycling are blended with the processes to provide emphasis on the application of the processes. The objective is to become familiar with the waste produced in mining, ore beneficiation, metallurgical operations, e-waste, utilization of waste, and their management. A wide variety of raw materials and dedicated recycling routes, concepts of material extraction, and recovery will be discussed. The importance of material pretreatment and the environmental benefits of material recycling have also been described.

2. Course Modules with quantitative lecture hours:

Module-I: Introduction to unit operations [6 Hours]

Introduction to materials recycling and waste management, Categories of metallurgical and electronic waste, Key unit operations involved in pre-treatment of metallurgical and electronic waste, Application of pyrometallurgy, hydrometallurgy and electrometallurgy and refining for Material separation and enrichment of raw materials.

Module-II: Materials Cycle [12 Hours]

Materials and their cycle, Introduction to recycling sustainability, energy accounting minerals, Energy consumption in primary production, Management of wastes from primary production, Present and future availability and demand of minerals and metals, Techniques of sustainable extraction from secondary materials.

Module-III: Metallurgical Waste Recycling [8 Hours]

Aluminium industrial waste: dross, scrap, red mud, spent pot lining, salt slag. Copper industrial waste: smelter slags, raffinates, spent electrolytes, Zinc industrial waste: zinc ash, zinc dross, flue dust, and scraps, Iron and Steelmaking waste, scraps, ironmaking slag, steelmaking slag and wastewater. Recycling and reuse of blast furnace ironmaking slags, steel-making dust, and sludges.

Module-IV: Electronic Waste Recycling [6 Hours]

Waste Printed Circuit Board, delamination and metal recovery, end-of-life batteries and

recovery of valuable materials from waste electrodes, rare earth elements comprising electronic waste (LEDs, magnets, etc.), and environmental impacts of materials recycling.

Module-V: Introduction to Circular Economy [8 hours]

From linear to circular economy, Cradle to Cradle concept, Eliminate waste and pollution, Circulate products and materials (at their highest value), Regenerate nature, Eliminate waste and pollution, Design changes, Focus on design to eliminate the concept of waste, Designers eliminating waste for a circular economy, Walter Stahel's The Performance Economy, William McDonough and Michael Braungart's Cradle to Cradle, Janine Benyus' Biomimicry, Industrial ecology, Regenerative design, Gunter Pauli's The Blue Economy, Systems thinking, Sustainable Development Goals (SDG) and linkages with Circular Economy model.

3. Textbooks:

1. P.C. Hayes, Process principles in minerals and materials production-with a focus on metal production and recycling, 2021.
2. L. Peter, Materials for a Sustainable Future, Royal Society of Chemistry Publishing, 2012.
3. J.A.S. Green, Aluminum Recycling and Processing for Energy Conservation and Sustainability, ASM International, 2007.
4. The Circular Economy: A Wealth of Flows, 2nd Edition Paperback, 1 January 2017 by Ken Webster (Author)
5. Cradle to Cradle: Remaking the Way We Make Things (Paperback) by William McDonough
6. Sustainability, Innovation, and Entrepreneurship. 1.0 Saylor Academy under a Creative Commons Attribution-Andy Schmitz, Publisher: Saylor Academy, Year Published: 2012
7. A New Dynamic: Effective Business in a Circular Economy by Amory Lovins

4. References:

1. Resource Recovery and Recycling from Metallurgical Wastes, Ed: S. Ramachandra Rao, Waste Management Series, 7, Elsevier B.V.
2. Electronic Waste Recycling Techniques, Hugo Marcelo Veit and Andrea Moura Bernardes, Topics in Mining, Metallurgy and Materials Engineering, Springer International Publishing Switzerland
3. Electronic Waste Management, R. E. Heister and R. M. Harrison, Issues in Environmental Science and Technology, 27, RSC Publishing, Cambridge

5. Similarity with the existing courses:

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Course Name	Course Code	Similarity Content	Approx. % of Content
1.	-	-	-	-

6. Justification of new course proposal if cumulative similarity content is >30%:

NA

Approvals:

Other Faculty interested in teaching this course: Dr. Viswanath Balakrishnan, Dr. Ravindra Naik Bukke, Dr. Rik Rani Koner and Dr. Sandip Chatterjee

Proposed by: Dr. Neha Shukla

School: SMME

Neha Shukla

Signature:

Date: 03.10.2024

The following faculty (at least 3) discussed on 24/09/2024 and approved the proposal on 03/10/2024.

Sl. No	Faculty Name	Signature
1.	Dr. Neha Shukla	<i>Neha Shukla</i>
2.	Dr. Viswanath Balakrishnan	<i>3.21</i>
3.	Dr. Ravindra Naik Bukke	<i>Ra</i>

School Chair: *7/10/24*

School:

Date:

This proposal is reported inthe Board of Academics on

Dean Academics

Date:

Note: School is responsible for the course code. Academic Office provides the IC Course Code.



Proposal for a New Course

Course number	: MT503
Course Name	: Semiconductor Materials and Devices
Credit	: 3
Distribution	: 3-0-0-3
Intended for	: B.Tech. (Elective) /M.Tech./Ph.D.
Prerequisite	: None
Mutual Exclusion	: None (<i>courses with high similarity not allowed to credit by the students after or along with this course</i>)

1. Preamble:

This course offers a detailed exploration of semiconductor materials and devices, from foundational principles to advanced fabrication technologies. Beginning with the history and market of semiconductors, it delves into the physics of semiconductor crystals, band structures, and carrier dynamics. Students will gain a strong understanding of key concepts such as doping, carrier transport, excitons, and phonons. The course also covers the structure and operation of semiconductor devices. Finally, advanced micro/nanofabrication technologies and their applications in modern electronics will be explored.

2. Course Modules with quantitative lecture hours

Introduction [8 hours]

History of semiconductors, semiconductor industry & market. Comprehensive understanding of semiconductor materials and their fundamental properties. Crystal properties, Intrinsic and extrinsic semiconductors, n-type and p-type semiconductors. Carrier dynamics, doping, and semiconductor junctions. Introduction to heavily doped semiconductors and their applications in modern electronics and devices.

Semiconductor Crystals and Band Structure [6 hours]

Semiconductor crystal properties (amorphous, crystalline, and polycrystalline), atoms, electrons, holes, and Schrodinger equation. Energy band formation, density of states, and fermi distributions in semiconductors, direct and indirect band gap semiconductors. Energy band diagram of semiconductor junctions, p-n junction, built-in voltage, electric field and potential distributions in p-n junctions and heterojunctions. Concept of holes, and carrier concentration.

Carrier in Semiconductors [10 hours]

Effective mass: heavy and light mass carriers, carrier concentration, excess carriers, charge neutrality, carrier transport (diffusion & drift) in semiconductors. Basics of conductivity, mobility, and resistivity in semiconductors, doping in semiconductors, and heavily doped semiconductors. Description of mobility and generation-recombination effects. Introduction to Excitons and optical properties, Phonons: formation and properties, lattice structure and vibrations, optical and acoustic phonons, thermal conductivity in semiconductors.

Semiconductor Contacts and Devices [10 hours]

Metal-semiconductor contacts, Schottky barriers, and ohmic contacts, field effect transistors (FET) metal-oxide-semiconductor (MOS) capacitor, metal-oxide-semiconductor field effect transistors (MOSFETs), MOSFET I-V equation, mobility calculation, short/long channel MOSFET. DRAM & RRAM, PN diodes: principles and operation, thin film transistors (TFT), active matrix organic LED



(AMOLED). Electrical characterization in various semiconductor devices. Optoelectronic Devices; solar cell, photodetectors, light emitting diodes (LED) and semiconductor lasers.

Advanced Micro/Nano Fabrication Technology [8 hours]

Basic micro/nanofabrication processes. Crystal growth and wafer preparation, Methods for p-n junction formation, Thin-film deposition processes. Doping techniques. Heavily doped semiconductors, impact of doping on electronic properties, application of semiconductors in modern electronics. Photolithography and etching. Advanced micro/nanofabrication technologies such as EUV, thin film transistors (TFT), complementary metal oxide semiconductors (CMOS), and 2D material integration. Basic principles of low-dimensional nanodevices.

3. Text & References:

- S. M. Sze: Physics of Semiconductor Devices. (John Wiley & Sons, Inc), 4th Edition, 2021
- C. Kittel, Introduction to Solid State Physics, 8th edition (John Wiley & Sons, 2005).
- N. W. Ashcroft and N. D. Mermin, Solid State Physics, Brooks Cole; 1 edition (January 2, 1976).
- Thin Film Materials: Stress, Defect Formation and Surface Evolution.
- Dieter K. Schroder: Semiconductor Material and Device Characterization. (Wiley), 3rd Edition, 2015

Any other Study Material:

- Students will be supplied with published journal articles as reference materials to support their studies.

5. Similarity with the existing courses:

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Course Code	Similarity Content	Approx. % of Content

6. Justification of new course proposal if cumulative similarity content is >30%: NA

Approvals:

Faculty interested in teaching this course: Dr. Viswanath Balakrishnan, Dr. Ranbir Singh, Dr. Swati Sharma, Dr. Neha Shukla, Dr. Suntharavel Mutthaiah, and Dr. Rik Rani Koner, Prof. Rahul Vaish, Dr. Sandeep Sahu, Dr. Dheeraj P Dube.

Proposed by: Dr. Ravindra Naik Bukke

School: SMME

Signature:

Date: 03/10/2024



The following faculty (at least 3) discussed the proposal on 24/09/2024 and approved it on 03/10/2024.

Sl. No	Faculty Name	Signature
1.	Dr. Viswanath Balakrishnan	
2.	Dr. Neha Shukla	
3.	Dr. Suntharavel Muthaiah	

School Chair:

 7/10/24

School:

Date:

This proposal is reported in the Board of Academics on

Dean Academics

Date:

Note: School is responsible for the Course Code. The Academic Office provides the IC Course Code.



Proposal for a New Course

Course number	: MT 504
Course Name	: Powder Metallurgical Processing of Materials
Credit	: 3
Distribution	: 3-0-0-3
Intended for	: B.Tech/PG/Ph.D.
Prerequisite	: None
Mutual Exclusion	: None None (<i>courses with high similarity not allowed to credit by the students after or along with this course</i>)

1. Preamble:

The course "Powder Metallurgical Processing of Materials" provides an in-depth study of powder metallurgy, a crucial field in modern materials science and engineering. Students will learn about powder production, characterization, compaction, and sintering processes, gaining insights into the mechanisms and factors influencing the properties of powder metallurgical products. Emphasizing both fundamental principles and advanced techniques, the course prepares students to address current and future challenges in the industry. By developing a deep understanding of powder metallurgy, this course aims to inspire innovation and excellence in materials research, development, and industrial applications.

2. Course modules with quantitative lecture hours: 42 Lectures

Unit-1: Introduction: Historical background, important steps in the powder metallurgy (P/M) process, advantages and limitations of the powder metallurgy process, and applications. [6 Lectures]

Unit-2: Powder Production: Production methods like physical, chemical, and mechanical methods; Single fluid atomization like rotating electrode atomization, roller atomization, and rotating disc atomization; Two fluid atomizations like gas atomization, water atomization, oil atomization, etc. Reduction methods, carbonyl process, hydride-dehydride process, electrolytic method. Mechanical milling, fluid energy grinding, machining. Production of ceramic powders. [8 Lectures]

Unit-3: Powder Characteristics: Sampling-chemical composition, particle shape and size analysis, Surface area, packing and low characteristics, Porosity and density, compressibility, and strength properties. Blending and mixing of metal powders. [8 Lectures]

Unit-4: Powder Compaction and Sintering: Compaction of powders, pressure less and pressure compaction techniques-single action and double action compaction, cold compaction, powder rolling, continuous compaction, explosive compaction, hot temperature compaction, uniaxial hot pressing, hot extrusion, spark sintering, hot isostatic pressing, injection moulding, sintering types, theory of sintering, process variables, effects of sintering, sintering atmospheres, and metallographic technique for sintered products. [8 Lectures]

Unit-5: Post-sintering operations: sizing, coining, repressing, and resintering; impregnation; infiltration; Heat treatment, steam treatment, machining, joining, plating; and other coatings. [6 Lectures].



Unit-6: Application of powder Metallurgy & products: Self-lubricating bearings, magnetic materials, tungsten carbide tool bits, bearing materials, dispersion-strengthening materials for high temperature applications, and manufacture of diamond-based cutting tools. [6 Lectures]

Laboratory/practical/tutorial Modules:

3. Text books:

1. Masuda H., Powder Technology Handbook, Taylor & Francis, 2006.
2. Angelo, P.C., and R. Subramanian, 'Powder metallurgy science, technology, and applications', Prentice Hall Publishers, 2008.

4. References:

1. German R.M., A to Z of Powder Metallurgy, Elsevier 2005.
2. Sands R.L. and Shakespeare C.R., Powder Metallurgy Practice and Applications, Newness Publication 1970.
3. Powder Metal Technologies and Applications, Metals Handbook, Vol. 7, 9th 1989 edition, ASM
4. Hirschhorn J.S., Introduction to Powder Metallurgy, APMI 1975
5. Upadhyaya G.S., Powder Metallurgy Technology, Cambridge Press 1996
- 6.

5. Similarity with the existing courses:

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Course Code	Similarity Content	Approx. % of Content
1.			

6. Justification of new course proposal if cumulative similarity content is >30%: NA

Approvals:

Faculty interested in teaching this course:

Dr. Viswanath Balakrishnan, Dr. Bukke Ravindra Naik, Dr. Neha Shukla, Dr. Sandeep Sahu

Proposed by: Dr V. M. Suntharavel Muthaiah **School:** SMME

V. M. Suntharavel Muthaiah

Signature:

Date: 03.10.2024



The following faculty (at least 3) discussed on 24/09/2024 and approved the proposal on 03/10/2024.

Sl. No	Faculty Name	Signature
01	Dr. Viswanath Balakrishnan,	
02	Dr. Bukke Ravindra Naik	
03	Dr. Sandeep Sahu	

School Chair:


7/10/24

School:

Date:

This proposal is reported in the Board of Academics on Dean Academics

Date:

Note: School is responsible for the course code. Academic Office provides the IC Course Code.



Proposal for a New Course

Course number	: MT505
Course Name	: Thin Film Technology
Credit	: 3
Distribution	: 3-0-0-3
Intended for	: B.Tech. (Elective) /M.Tech./Ph.D.
Prerequisite	: None
Mutual Exclusion	: None (<i>courses with high similarity not allowed to credit by the students after or along with this course</i>)

1. Preamble:

Thin film science encompasses multiple disciplines, like materials science, chemistry, solid-state physics, and mechanics. They are designed specifically for students interested in gaining a deep understanding of thin film fundamentals and processing for a wide range of industrial applications. This course offers a comprehensive understanding of the subject, bridging the gap between theoretical knowledge and practical applications.

2. Course Modules with quantitative lecture hours

Introduction [6 hours]

This course provides a comprehensive understanding of the science and technology behind the growth of inorganic solid thin films and coatings. It introduces key characterization techniques for real-time and post-growth analysis. The second part emphasizes project-based learning, exploring thin film applications tailored to student interests. Key concepts in vacuum technology, components, and plasma will also be introduced, as these are essential for understanding thin film deposition processes.

Thin film growth [12 hours]

Introduction of thin film deposition techniques: Physical Vapor Deposition (PVD) methods like sputtering and ion-beam, and Chemical Vapor Deposition (CVD) processes such as APCVD, MOCVD, and PECVD. Solution-based methods include ink-jet printing, spin coating, and spray pyrolysis. Other advanced techniques include Atomic Layer Deposition (ALD), Pulsed Laser Deposition (PLD), and Molecular Beam Epitaxy (MBE). Along with these techniques, it is essential to understand the basic mechanisms of thin film growth from the vapour phase for a complete understanding of the process.

Thin film characteristics [12 hours]

Introduction of optical, physio-chemical, mechanical, and electrical properties of thin films. Optical properties: optical microscope, and UV-Vis Spectroscopy for absorption, transparency, and refractive index. Physio-chemical properties: thickness, film density, chemical composition, structure, and surface morphology, analyzed through Ellipsometry, XRR, XPS, XRD, SEM, TEM, and AFM. Electrical properties involve conduction phenomena and Hall measurements. Mechanical properties address thin film stress and wafer curvature using Stoney's equation, bulge tests, and other methods to understand residual stresses in thin films.

Thin film applications [8 hours]

Thin films are widely used in batteries, resistors, solar cells, and photovoltaics. They also play a key role in Microelectromechanical (MEMS) and Nanoelectromechanical (NEMS) systems, sensors,



actuators, memristors, diodes, thin film transistors, and display technologies, contributing to advancements in electronics, energy, and display industries.

3. Text & References:

- Thin Film Materials: Stress, Defect Formation and Surface Evolution
- Thin Film Coatings_ Properties, Deposition, and Applications- (Emerging Materials and Technologies) Fredrick Madaraka Mwema, Tien-Chien Jen, Lin Zhu - CRC Press (2022)
- Krishna Seshan, Dominic Schepis - Handbook of Thin Film Deposition-William Andrew, 2018.
- K. S. Sree Harsha, Principles of Vapor Deposition of Thin Films, 2006, Elsevier
- K. Seshan, Handbook of Thin-Film Deposition Processes and Techniques, 2002, William Andrew Publishing
- John E. Mohan, Physical Vapor Deposition of Thin Film, John Wiley & Sons, 2000

Any other Study Material:

- Students will be supplied with published journal articles as reference materials to support their studies.

4. Similarity with the existing courses:

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Course Code	Similarity Content	Approx. % of Content

5. Justification of new course proposal if cumulative similarity content is >30%: NA

Approvals:

Faculty interested in teaching this course: Dr. Viswanath Balakrishnan, Dr.Neha Shukla, Dr. Rik Rani Koner, Dr. Jaspreet K R, Dr. Swati S, Dr. Ranbir S, Dr. Sandeep S, Dr. Suntharvel M, Dr. Dheeraj P D, Dr. Sudhir P, Prof. Rahul V.

Proposed by: Dr. Ravindra Naik Bukke

School: SMME

Signature:

Date: 03/10/2024



The following faculty (at least 3) discussed the proposal on 24/09/2024 and approved it on 03/10/2024.

Sl. No	Faculty Name	Signature
1.	Dr. Viswanath Balakrishnan	
2.	Dr.Neha Shukla	
3.	Dr. Rik Rani Koner	

School Chair:


7/10/24

School:

Date:

This proposal is reported in the Board of Academics on

Dean Academics

Date:

Note: School is responsible for the Course Code. The Academic Office provides the IC Course Code.



Proposal for a New Course

Course number : MT506
Course Name : Biomaterials
Credit : 3
Distribution : 3-0-0-3
Intended for : B.Tech./PG./Ph.D.
Prerequisite : None
Mutual Exclusion : None (*courses with high similarity not allowed to credit by the students after or along with this course*)

Preamble:

This course provides a comprehensive study of key biomaterials that are transforming the fields of biomedical science and engineering. Topics covered include biodegradable polymers for tissue engineering, biologically-derived materials, and their applications in soft and hard tissues. Students will establish a strong foundation in biomaterial principles and emerging technologies, equipping them to contribute to next-generation medical solutions. The course emphasizes the significant impact of recent advancements in biotechnology, material science, and surgical innovations on the development and use of biomaterials in medicine and dentistry, fostering a deep understanding of their properties, design, and healthcare applications.

1. Course Content

Unit 1: Introduction and importance of biomaterials: Overview of biomaterials and their critical role in modern medicine. Understanding the interdisciplinary nature of biomaterials, integrating biology, chemistry, engineering, and materials science. The impact of biomaterials in medical devices, implants, and tissue engineering **(6 Hours)**

Unit 2: Types of biomaterials: Metallic Biomaterials: Stainless Steels, CoCr Alloys, Ti Alloys, Dental Metals, Other Metals, Corrosion of Metallic Implants, Manufacturing of Implants
Ceramic Biomaterials: Nonabsorbable or Relatively Bio inert Bio ceramics, Biodegradable or Resorbable Ceramics, Bioactive or Surface-Reactive Ceramics, Deterioration of Ceramics, Bio ceramic Manufacturing Techniques

Polymeric Biomaterials: Polymerization and Basic Structure, Polymers Used as Biomaterials, Sterilization, Surface Modifications for Improving Biocompatibility, Chemo gradient Surfaces for Cell and Protein Interaction

Composite Biomaterials: Structure, Bounds on Properties, Anisotropy of Composites, Particulate Composites, Fibrous Composites, Porous Materials, Biocompatibility. **(10 Hours)**

Unit 3: Classification according to physiological response of biomaterials: Bio inert, bioactive and bioresorbable biomaterials, Surface modifications, Surface analysis, Surface-protein interactions **(4 Hours)**



Unit 4: Biodegradable Polymeric Biomaterials: Glycolide/Lactide Based Biodegradable Linear Aliphatic Polyesters, Non-Glycolide/Lactide Based Linear Aliphatic Polyesters. Non-Aliphatic Polyesters Type Biodegradable Polymers, Biodegradation Properties of Synthetic Biodegradable Polymers. Hydrolytic Degradation. Enzymatic Degradation, Surface vs. Bulk Erosion: **(10 Hours)**

Unit 5: Cell interactions with biomaterials: General introduction to cellular structure and functions, Techniques and assays to determine the cell material interactions (Cytotoxicity Assays, Direct Contact Assay, Agar Diffusion Assay, Elution Assay, Adhesion/Spreading Assays, Migration Assays) **(4 Hours)**

Unit 6: Biomaterials implants and implementation problems: Orthopaedic implants, artificial organs, dental materials, etc.; Implementation problems - inflammation, rejection, corrosion, structural failure. **((8 Hours)**

Unit 7: Applications of biomaterials in various medical conditions: Wound Healing and the Presence of Biomaterials, Biomaterials and Thrombosis. **(4 Hours)**

References –

1. Johnna S. Temenoff, Antonios G. Mikos Biomaterials the Intersection of Biology and Materials Science (2008, Pearson) by Johnna S. Temenoff, Antonios G.
2. B. Rolando (Ed.) Integrated Biomaterials Science. Springer. 2002. ISBN: 0-306-46678-3
3. J.B. Park and J.D. Bronzino. Biomaterials: Principles and Applications. CRC Press. 2002. ISBN:0849314917.

Approvals:

Faculty interested in teaching this course: – Dr. Jaspreet, Dr. Swati, Dr. Suntharavel, Dr. Neha

Proposed by: Dr. Jaspreet

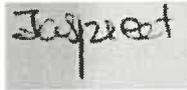
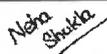
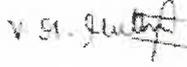
School: SMME

Signature:

Date: 03.10.2024



The following faculty (at least 3 faculty) discussed on 24/09/2024 and approved the proposal on 03/10/2024.

Sl. No	Faculty Name	Signature
1.	Dr. Jaspreet Randhawa	
2.	Dr. Neha Shukla	
3.	Dr. Suntharavel VM	

School Chair:



School:

Date:

This proposal is reported inth Board of Academics on

Dean Academics

Date:



Proposal for a New Course

Course number : MT507
Course Name : Modeling and Simulation in Materials Science
Credit : 3
Distribution : 3-0-0-3
Intended for : B.Tech.
Prerequisite : None
Mutual Exclusion : None (*courses with high similarity not allowed to credit by the students after or along with this course*)

1. Preamble:

This course in Modeling and Simulation of Material Science provides students with a comprehensive introduction to computational tools and techniques used in material analysis and discovery. Emphasis is placed on understanding the statistical mechanics foundations, covering thermodynamic principles and ensemble theories crucial for modeling complex material systems. Students will also explore molecular dynamics, Monte Carlo methods, and simulations of specific material types, bridging theoretical knowledge with practical, hands-on applications. The course equips students with the skills to simulate real-world material behaviors, from crystalline structures to nanomaterials.

2. Theory:

1. Motivation - Introduction to Modeling and Simulation

- The need for modeling and simulation techniques in material science
- Experimental measurements and computational calculation of materials properties
- The role of modeling in predicting material performance and design.

2. Molecular Dynamics (MD) Simulations

- Thermodynamics and statistical mechanics principles and Ensembles
- Basic principles and algorithms (Verlet, leapfrog)
- Force fields and potentials for material systems
- Integration schemes and time step considerations

3. Monte Carlo (MC) Simulations

- Importance sampling and the Metropolis algorithm
- Canonical ensemble MC
- Applications in materials (e.g., phase transitions)

4. Interatomic Potentials

- Lennard-Jones potential, Coulombic interactions
- Embedded Atom Model (EAM) for metals
- Force field development and selection for different materials



5. Modeling Phase Transitions

- Modeling solid-solid and solid-liquid transitions
- Nucleation and growth processes

6. Simulation of Specific Material Types

- Crystalline materials: Simulation of defects, dislocations, and fracture in metals
- Nanomaterials: Deformation of nanowires and analysis of grain boundaries

7. Other examples for modelling

- Grain Boundary Generation of Al
- Dislocation Nucleation in Single Crystal Al
- Grain Boundary Generation of Cu and Mg

3. Text books:

Daan Frenkel – Understanding molecular simulation.

4. References:

- Introduction to Computational Materials Science by Richard LeSar
- Monte Carlo Methods in Statistical Physics by Kurt Binder and Dieter W. Heermann
- Computational Materials Science: An Introduction by June Gunn Lee

5. Similarity with the existing courses: (Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Course Code	Similarity Content	Approx. % of Content

6. Justification of new course proposal if cumulative similarity content is >30%:

Approvals:

Faculty interested in teaching this course: – Dr. Dube Dheeraj Prakashchand and Dr. Sudhir Pandey.

Proposed by:

Dr. Dube Dheeraj Prakashchand

School: SMME

D. Dube

Signature:

Date:03.10.2024



The following faculty (at least 3) discussed on 24/09/2024 and approved the proposal on 03/10/2024.

Sl. No	Faculty Name	Signature
1.	Dr. Dube Dheeraj Prakashchand	
2.	Dr. Ranbir Singh	
3.	Dr. Sudhir Pandey.	

School Chair:

7/10/24

School:

Date:

This proposal is reported inthe Board of Academics on

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.



Proposal for a New Course

Course number : MT508
Course Name : Iron and Steel Making
Credit : 3
Distribution : 3-0-0-3
Intended for : B.Tech./PG/Ph.D.
Prerequisite : None
Mutual Exclusion : None (*courses with high similarity not allowed to credit by the students after or along with this course*)

1. Preamble:

The emphasis on extractive metallurgy like ironmaking and steelmaking has been reduced to make room for newer courses on advanced materials. This is contrary to the fact that India is the second-largest producer of crude steel in the world. Besides, after the globalization of the market, we stand in cut-through competition for day-to-day innovation in steel processing. Based on changing scenarios, a conceptual, fundamental, and more quantitative course is desirable. Keeping in view of the above considerations, the course has been designed.

2. Course Modules with quantitative lecture hours:

Module-I: Introduction to Iron Making [6 Hours]

Introduction: Various routes of modern steel making (BF-BOF, DRI-EAF, SR). Blast furnace Ironmaking: Shape of the furnace, Various reactions, and zones in the blast Furnace Thermodynamics of Iron making, Direct & indirect reduction Blast furnace as an efficient counter-current gas-solid reactor with maximum carbon efficiency.

Module-II: Heat and Mass Transfer in the blast furnace [8 Hours]

Overall heat and material balance in the blast furnace. Rist diagram based on oxygen balance. Rist diagram based on heat & material balance. Blast furnace as a two-stage reactor. A predictive model for coke rate in the blast furnace.

Module-III: Transport processes in a blast furnace [6 Hours]

Aerodynamics in Blast Furnace (pressure drop, fluidization, channeling, flooding). Burden preparation (sintering, pelletization, coke making). Testing of raw materials. Burden distribution in blast furnace. Auxiliary injection, fuel efficiency, and productivity in blast furnaces.

Module-IV: Steelmaking Fundamentals [8 hours]

Thermodynamics of steelmaking. Introduction to LD steel making (process, emulsion, decarburization, catch carbon technique, impurity & slag evolution). Hybrid steel making. Modern EAF/IF steel making. Secondary Steelmaking: Thermodynamics & kinetics of deoxidation. Secondary steel making: Vacuum treatment of steel and processes, gas stirring

Module-V: Secondary Steelmaking and Alternative Ironmaking Routes [10 Hours]

Secondary Steelmaking: Ladle desulphurization, inclusion modification by calcium treatment.

Inclusion control by optimizing upstream operating parameters. Heat transfer and segregation during casting. Ingot casting, continuous casting, defects in steel. Environmental issues related to ironmaking; Alternative routes of iron & steel making (rotary kiln, Corex, Midrex).

3. Textbooks:

1. H.S. Ray and A. Ghosh, Principles of extractive metallurgy, Wiley Eastern Ltd., New Delhi (1991).
2. Modern ironmaking, Dr. R. H. Tupkary.
3. Manufacture of Iron & Steel, R.W. Backforth Vol. I
4. Physical Chemistry of Iron & Steel, G. Word
5. Principals of Blast Furnace Ironmaking by A.K. Biswas
6. Modern Steelmaking, Dr. R.H. Tupkary.
7. Fundamentals of steel making by E.T. Tukdogan

References:

1. Turkdogan, E.T., and Fruehan, R.J., 1998. Fundamentals of iron and steelmaking. The Making, Shaping and Treating of Steel, Steelmaking and Refining Volume, 11th ed., RJ Fruehan, ed., AISE Steel Foundation, Pittsburgh, 11, pp. 125-126.
2. Secondary processing and casting of liquid steels—A. Ghosh

4. Similarity with the existing courses:

(Similarity content is declared as per the number of lecture hours on similar topics.)

S. No.	Course Name	Course Code	Similarity Content	Approx. % of Content
1.				
2.				

5. Justification of new course proposal if cumulative similarity content is >30%:

NA

Approvals:

Other Faculty interested in teaching this course: Dr. Viswanath Balakrishnan, Dr. Ravindra Naik Bukke, and Dr. Sandip Chatterjee

Proposed by: Dr. Neha Shukla

School: SMME

Neha Shukla

Signature:

Date: 03.10.2024

The following faculty (at least 3) discussed on 24/09/2024 and approved the proposal on 03/10/2024.

Sl. No	Faculty Name	Signature
1.	Dr. Neha Shukla	
2.	Dr. Viswanath Balakrishnan	
3.	Dr. Ravindra Naik Bukke	

School Chair:


7/10/24

School:

Date:

This proposal is reported inthe Board of Academics on

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Indian
Institute of
Technology
Mandi



Proposal for a New Course

Course Number : MT509
Course Name : Hydrogen Energy
Credit : 3
Distribution : 3-0-0-3
Intended for : B.Tech/PG/Ph.D.
Prerequisite : None
Mutual Exclusion : Some similarly with 'Hydrogen Generation and Storage' course -CY552, running at School of Chemical Sciences (*courses with high similarity not allowed to credit by the students after or along with this course*)

Preamble: This course on hydrogen energy provides a comprehensive foundation in the production, storage, and utilization of hydrogen as a sustainable energy carrier. It covers key methods of hydrogen production from hydrocarbons and renewable sources, explores advanced storage techniques, and delves into transportation and distribution challenges. Students will also study hydrogen's applications in energy systems and its critical role in decarbonization. Emphasis is placed on understanding the technical, economic, and safety considerations associated with hydrogen energy technologies, preparing students to engage with emerging challenges and innovations in this field.

Course modules with quantitative lecture hours:

Unit 1: Introduction to Hydrogen Energy and Production

Properties of hydrogen, global status of supply and demand, and key hydrogen production methods (steam reforming, partial oxidation, autothermal reforming). Comparison of conventional and advanced methods, and production from hydrocarbons and biomass. (6 Hours)

Unit 2: Hydrogen Production from Renewable Sources

Thermochemical cycles for hydrogen production, electrolysis of water (fundamentals, electrolytic cell design, stack configuration), photoelectrochemical hydrogen production, and a comparative technical and economic analysis of various production methods. (6 Hours)

Unit 3: Hydrogen Storage

Introduction to hydrogen storage methods, fundamentals of hydrogen compression, liquefaction, and underground storage. Hydrogen storage in tanks and adsorption-based materials, metal hydrides, and design of hydrogen storage systems. (6 Hours)

Unit 4: Transportation and Distribution of Hydrogen

Long-distance hydrogen transport via pipelines, ships, and as liquid organic hydrogen carriers (LOHC). Road transportation of hydrogen and refueling stations. Economic analysis of transport methods. (4 Hours)

Unit 5: Utilization of Hydrogen

Hydrogen use in internal combustion engines, fuel cells, and other energy conversion devices. Applications of hydrogen in different sectors, with a focus on decarbonization. (6 Hours)

Unit 6: Hydrogen Safety and Regulations

Properties of hydrogen associated with hazards, safety concerns in storage and transport, classification of hazards, safety regulations, codes, and standards. Case studies of hydrogen incidents and mitigation strategies. (6 Hours)

Text books:

1. Gupta, Ram B., Hydrogen Fuel: Production, Transport and Storage, CRC Press, Taylor & Francis Group, 2008.

Reference books:

1. Tzimas, E., Filiou, C., Peteves, S.D., & Veyret, J.B. "Hydrogen storage: state-of-the-art and future perspective. Netherlands": European Communities, 2003.
2. Agata Godula-Jopek, Hydrogen Production by Electrolysis, Wiley-VCH, Germany, 2015
3. Global Hydrogen Review 2021, IEA (2021), Paris, <https://www.iea.org/reports/global-hydrogen-review-2021>
4. Michael Hirscher, "Handbook of Hydrogen Storage", Wiley-VCH, 2010.
5. Yuda Yürüm, editor. Hydrogen energy system: production and utilization of hydrogen and future aspects. Springer Science & Business Media; NATO ASI Series, Series E: Applied Sciences – Vol. 295, 2012.

1. **Similarity with the existing courses:** Some similarity with the course offered in School of Chemical Sciences (SCS) as given below. (Similarity content is declared as per the number of lecture hours on similar topics)

S. No.		Course Code	Similarity Content	Approx. % of Content
1.	Hydrogen Generation and Storage	CY 552	Hydrogen Production and Storage	25%

6. Justification of new course proposal if cumulative similarity content is >30%:

This course addresses a critical gap in the Materials Science & Engineering curriculum, tailored for B.Tech., M.Tech./M.Sc., and Ph.D. students. With the global shift towards renewable energy and decarbonization, hydrogen energy is a pivotal area of research and application. The course provides a thorough understanding of hydrogen energy systems, vital for students involved in material development and energy systems. By offering an in-depth look at production, storage, and utilization technologies, it equips students to contribute to the evolving field of hydrogen energy.

Approvals:

Faculty interested in teaching this course: –

Dr. Sandeep Sahu, Dr. Rik Koner, Dr. Neha Shukla, Dr. Ravindra Naik Bukke, Dr. Viswanath Balakrishnan

Proposed by: Dr. Sandeep Sahu

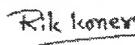
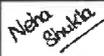
School: SMME

Signature:



Date: 03/10/2024

The following faculty (at least 3) discussed on 24/09/2024 and approved the proposal on 03/10/2024.

Sl. No	Faculty Name	Signature
01	Dr. Viswanath Balakrishnan	
02	Dr. Rik Koner	
03	Dr. Neha Shukla	

School Chair:



School:

Date:

This proposal is reported in the Board of Academics on Dean
Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Proposal for a New Course



Proposal for a New Course

Course number : MT510
Course Name : Colloids and Interfaces
Credit : 3
Distribution : 3-0-0-3
Intended for : B.Tech./PG/Ph.D.
Prerequisite : None
Mutual Exclusion : None (*courses with high similarity not allowed to credit by the students after or along with this course*)

1. Preamble:

This course introduces the fundamental concepts and tools for analyzing colloids and interfaces, essential nano-entities in fields like chemical engineering and manufacturing. Key applications include adhesion, particle aggregation, wetting, detergency, oil recovery, and more. The multidisciplinary nature of colloids and interfaces makes them crucial for a wide range of classical phenomena and industrial processes.

2. Course Content:

Unit 1: Introduction to colloid and interface: colloids, classification of colloids based on affinity to carrier fluids, concept of stability of colloidal systems (DLVO and DLVO like theories and kinetics of coagulation and general principles of diffusion in a potential field/Brownian movement, physical characteristics of colloids, interfaces, Natures of interfaces, Thermodynamics of Interfaces, Adsorption and deposition at surfaces and interfaces **(10 Hours)**

Unit 2: Surface Tension, Adhesion and Capillarity: Effect of confinement and finite size, concepts of surface and interfacial energies and tensions, Surface Tension, Contact Angle, Thermodynamics of Surfaces: Surface Tension as Surface Free Energy, Surface Tension: Implications for Curved Interfaces and Capillarity, Effects of Curved Interfaces on Phase Equilibria and Nucleation: The Kelvin Equation, Surface Tension and Contact Angle: Their Relation to Wetting and Spreading Phenomena, Contact Angles: Some Complications, Contact of Liquids with Porous Solids and Powders, Molecular Interpretation of Surface Tension, Apolar (Van Der Waals) and polar(acid-base) components of interfacial tensions. Young-Laplace equation of capillarity, examples of equilibrium surfaces, multiplicity. Free energies of adhesion, kinetics of capillary and confined flows **(10 Hours)**

Unit 3: The Rheology of Dispersions: Introduction, Newton's Law of Viscosity, Concentric-Cylinder and Cone-and-Plate Viscometers, The Poiseuille Equation and Capillary Viscometers, The Equation of Motion: The Navier-Stokes Equation, Einstein's Theory of Viscosity of Dispersions, Deviations from the Einstein Model, Non-Newtonian Behavior, Viscosity of Polymer Solutions **(10 Hours)**

Unit 4: Van der Waals Forces: Introduction and importance of Van der Waals Forces, Molecular Interactions and Power Laws, Molecular Origins and the Macroscopic Implications of van der Waals Forces, van der waals forces between large particles and over large Distances, calculating van der waals forces between macroscopic bodies, Theories of van der Waals Forces based on Bulk Properties, Effect of the medium on the van der Waals Attractions. **(8 Hours)**



Unit 5: Electric Double layer: Background of surface charges and electrical, capacitor model of the double layer, diffuse double layer, Debye- Huckel Approximation, electrical double layer, Gouy-Chapman Theory, overlapping Double layer and interparticle repulsion, stern adsorption (8 Hours)

3. Text books:

1. P.C. Hiemenz and R. Rajagopalan (Editors), Principles of Colloid and Surface Chemistry, 3rd Ed., Academic Press, New York, 1997.
2. T. Cosgrove, Colloid Science: Principles, Methods and Applications, Wiley-Blackwell, 2005
- 3.

4. Similarity with the existing courses:

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Course Code	Similarity Content	Approx. % of Content

5. Justification of new course proposal if cumulative similarity content is >30%: NA

Approvals:

Faculty interested in teaching this course: –Dr. Jaspreet Randhawa, Dr. Neha Shukla, Dr. Rik Rani Koner, Dr Ranbir, Dr. Ravindra Naik Bukke, Dr. Viswanath

Proposed by: Dr. Jaspreet Kaur Randhawa

School: SMME

Signature:

Date:

The following faculty (at least 3) discussed the proposal on 24/09/2024 and approved it on 03/10/2024.

Sl. No	Faculty Name	Signature
1.	Dr. Jaspreet Randhawa	
2.	Dr. Neha Shukla	
3.	Dr. Rik Rani	



School Chair:  7/10/24

School:

Date:

This proposal is reported inthe Board of Academics on

Dean Academics

Date:

IIT Mandi

Proposal for a New Course

Course number : MT511
Course Name : Sensor Materials and Technologies
Credit : 3
Distribution : 3-0-0-3
Intended for : B.Tech./M.Tech./M.Sc./Ph.D.
Prerequisite : None
Mutual Exclusion : None (*courses with high similarity not allowed to credit by the students after or along with this course*)

1. Preamble:

Sensors are essential components of nearly all modern electronic devices, with the intelligence of any gadget closely tied to the number and types of sensors it incorporates. Gaining a deep understanding of sensor technologies is therefore crucial for driving innovation in both science and technology. This course is designed to acquire knowledge on sensor materials, design, fabrication, data acquisition and analysis, covering the full spectrum of sensor technologies from basic principles to advanced techniques. By exploring standard sensors, microfabrication processes, and diverse applications, students will be equipped to grasp both fundamental principles and advanced sensor technologies.

2. Course Content:

Unit 1: Introduction and Fundamental Concepts: Overview of sensors, materials used for sensors, multidisciplinary aspects of sensor technology, key sensor parameters such as sensitivity, range, accuracy, and resolution. **(5 hours)**

Unit 2: Sensor Materials: Examination of sensor materials including silicon, plastics, metals, ceramics, structural glasses, optical glasses, and nanomaterials. **(4 hours)**

Unit 3: Physical Principles of Sensing: Study of sensing principles for various physical phenomena, including force, temperature, vibration, pressure, flow, and optical properties. This section also explores a range of sensors such as piezoelectric, electrical, acoustic, pneumatic, magnetic, optical, and pH sensors. **(7 hours)**

Unit 4: Sensor Fabrication and Characterization: Overview of fabrication processes such as surface processing (spin casting, vacuum deposition, sputtering, chemical vapor deposition, electroplating). Introduction to Microelectromechanical Systems (MEMS) technologies, including lithography, silicon micromachining, micromachining of bridges and cantilevers, lift-off, wafer bonding, and LIGA technologies. Fundamentals of etching techniques (both wet and dry), and microscopy techniques (optical and electron microscopy, among others). **(12 hours)**

Unit 5: Signal Conditioning, Processing, and Display Systems: Covers signal conditioning methods like deflection bridges, amplifiers, A.C. carrier systems, current transmitters, oscillators, and resonators. Signal processing techniques such as analog-to-digital conversion, computer and microcontroller systems, and related software. Discusses data display methods, including pointer-scale indicators, LED displays, cathode ray tubes (CRT), liquid crystal displays (LCDs), and electroluminescence (EL) displays. **(12 hours)**

Unit 6: Sensor Applications in Various Fields: Exploration of sensor applications, covering occupancy and motion detectors, position and displacement sensors, velocity, and acceleration sensors, as well as force, strain, tactile, pressure, and temperature sensors. Specific applications include sensors utilized in CNC machine tools (linear and angular position, velocity sensors) and acoustic emission, accompanied by an introduction to concepts in pattern recognition. **(4 hours)**

3. Textbooks:

1. John P. Bentley, Principles of Measurement Systems, Pearson Education, 4th Edition, 2005.
2. S.M. Sze, Semiconductor sensors, John Wiley & Sons Inc., 3rd Edition, 2006.
3. J. Fraden, Handbook of Modern Sensors: Physical, Designs, and Applications, AIP Press, Springer
4. Neil W. Ashcroft and N. David Mermin, Solid State Physics, Saunders College Publishing, 1976

Approvals:

Faculty interested in teaching this course: – Dr. Ranbir Singh, Dr. Jaspreet Randhawa, Dr. Viswanath Balakrishnan

Proposed by: Dr. Ranbir Singh

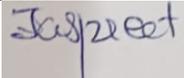
School: SMME



Signature:

Date: 03.09.2024

The following faculty (at least 3 faculty) discussed on 24/09/2024 and approved the proposal on 03/10/2024.

Sl. No	Faculty Name	Signature
1.	Dr. Ranbir Singh	
2.	Dr. Jaspreet Randhawa	
3.	Dr. Viswanath Balakrishnan	

School Chair:

School:

Date:

This proposal is reported inthe Board of Academics on

Dean Academics

Date:



IIT Mandi

Proposal for a New Course

Course number : HC600
Course Name : Research Methodology
Credit Distribution : 1-0-0-1
Intended for : M.Tech, M.Tech(R) and Ph.D
Prerequisite : None
Mutual Exclusion : None

1. Preamble:

This course is an overview on research methodologies pertaining to research on human computer interaction. The course tours through a discussion on methods and practices related to research on human computer interaction. Because HCI research takes place at the intersection of many different disciplines, it is important to always be aware of standards and expectations in the related disciplines. The course ensures appropriate connection between human computer interaction and related disciplines especially in terms of methods and practices.

2. Course Modules with quantitative lecture hours:

1. Introduction to research methodologies
2. Literature review
3. Experiment design
4. Statistical analysis
5. Surveys and interviews
6. Case studies
7. Ethnography
8. Usability testing

9. Analyzing qualitative data
10. Automated data collection methods
11. Measuring the human: Real time testing and need for ethical clearance
12. Ubiquitous HCI research
13. Research with human subjects with and without disabilities
14. Interdisciplinarity in research

Laboratory/practical/tutorial Modules: N.A.

3. Text books: N.A.

(Relevant and Latest, Only 2)

4. References: N.A.

(No limit on numbers, relevant standard format can be followed, the formats should be similar)

5. Similarity with the existing courses:

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.		Course Code	Similarity Content	Approx. % of Content
1.				

6. Justification of new course proposal if cumulative similarity content is >30%:

Approvals:

Other Faculty interested in teaching this course: –

Dr. Viswanath Balakrishnan, Dr. Anirban Sarkar, Dr. Varun Dutt

Proposed by: Dr. Shubhajit Roy Chowdhury

School: CHCI

Signature:

Date:

Recommended/Not Recommended, with Comments:

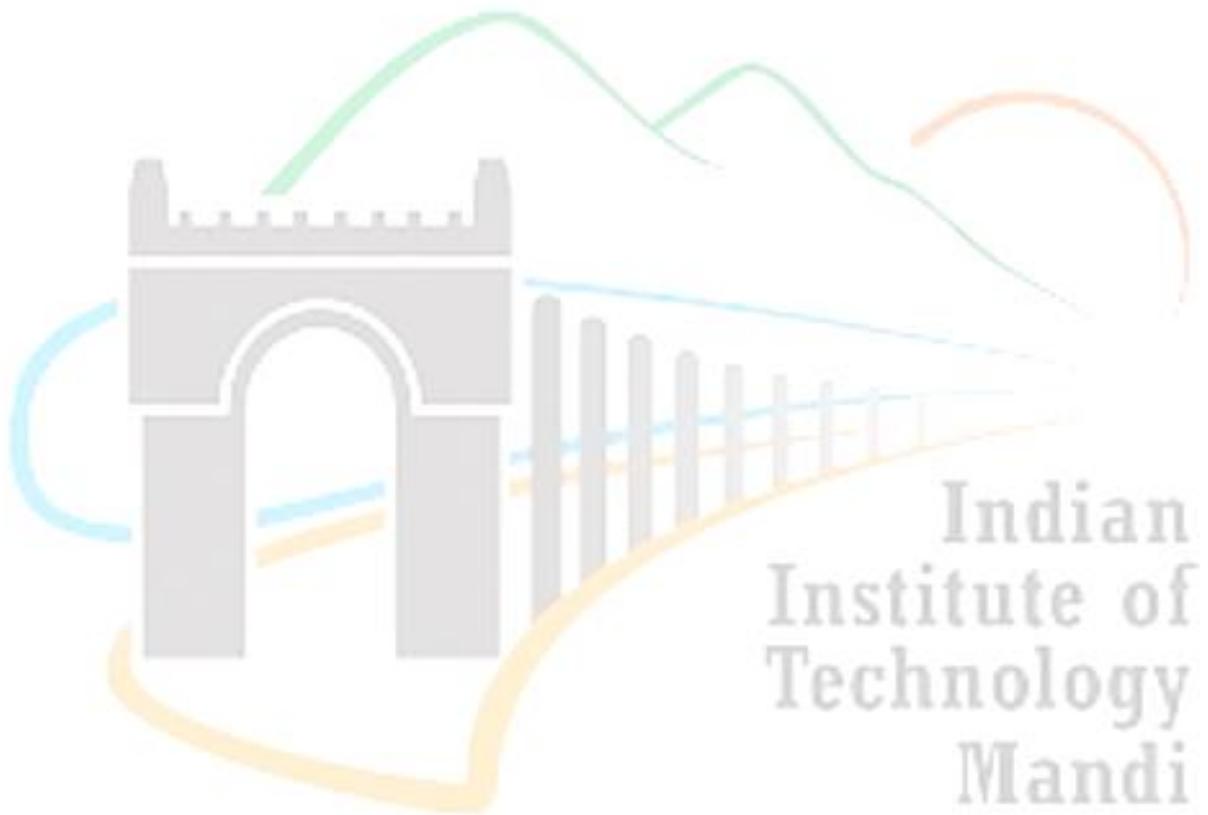
_____ **Chairperson, CPC**

Date: _____

Approved / Not Approved

_____ **Chairperson, BoA**

Date: _____



Annexure I

M.Sc. Chemistry Credit Distribution (August 2025 Onwards)

S. No.	Component	Credits
1	Discipline Core Courses	29
2	Specialization/Discipline Electives	15
3	Laboratory Courses	9
4	Free Electives	12
5	Design Practicum (P/F)	2
6	Post Graduate Project (PGP)	14
	Total	81

SEMESTER-WISE CURRICULUM

First Semester:

Course No.	Course Title	L-T-P-C
CY-531	Organic Reactions and Mechanism	3-0-0-3
CY-533	Chemistry of Main Group Elements	3-0-0-3
CY-512	Advanced Quantum Chemistry	3-0-0-3
CY-XYZ	Discipline Elective - I	3-0-0-3
CY-512P	Physical Chemistry Laboratory	0-0-6-3
CY-533P	Inorganic Chemistry Laboratory	0-0-6-3
CY-561P	Design Practicum - I	0-0-2-1
	Total	19

Second Semester:

Course No.	Course Title	L-T-P-C
CY-532	Photochemistry & Pericyclic Reactions	3-0-0-3
CY-534	Chemistry of Transition Elements	3-0-0-3
CY-511	Symmetry and Group Theory	3-0-0-3
CY-XYZ	Discipline Elective - II	3-0-0-3
CY-XYZ	Discipline Elective - III	3-0-0-3
CY-531P	Organic Chemistry Laboratory	3-0-0-3
CY-562P	Design Practicum - II	0-0-2-1
	Total	19

Third Semester:

Course No.	Course Title	L-T-P-C
CY-XYZ	Discipline Elective - IV	3-0-0-3
CY-514	Chemical & Statistical Thermodynamics	3-0-0-3
CY-535	Introduction Organometallic Chemistry	3-0-0-3
	Free Elective - I	3-0-0-3
	Free Elective - II	3-0-0-3

CY-563P	Post Graduate Project – 1	0-0-10-5
	Total	20

Fourth Semester:

Course No.	Course Title	L-T-P-C
CY-504	Reaction Dynamics, Kinetics & Catalysis	3-0-0-3
CY-513	Heterocyclic Chemistry	2-0-0-2
CY-XYZ	Discipline Elective - V	3-0-0-3
	Free Elective - III	3-0-0-3
	Free Elective - IV	3-0-0-3
CY-564P	Post Graduate Project - 2	0-0-16-8
	Total	22

LIST OF DISCIPLINE ELECTIVE COURSES

S N	Course code	Course Title	L-T-P-C
1	CY-515	Advanced Inorganic Spectroscopy	3-0-0-3
2	CY-541	Fundamentals of Organic Chemistry	3-0-0-3
3	CY-547	Chemical Crystallography	2-0-2-3
4	CY-550	Bioinspired Materials	3-0-0-3
5	CY-552	Hydrogen Generation and Storage	3-0-0-3
6	CY-554	Science and Technology of Nanomaterials	3-0-0-3
7	CY-555	Introduction to Polymer Science & Technology	3-0-0-3
8	CY-556	Organic Spectroscopy	3-0-0-3
9	CY-558	Inorganic Chemistry for Sustainability	3-0-0-3
10	CY-641	Polymer Synthesis	3-0-0-3
11	CY-642	Molecular and Bio-electronics	3-0-0-3
12	CY-643	Advanced Analytical Techniques	3-0-0-3
13	CY-644	Bioinorganic Chemistry	3-0-0-3
14	CY-645	Reagents in Organic Synthesis	3-0-0-3
15	CY-670	Fluorescence spectroscopy, microscopy and application	3-0-0-3

IIT Mandi

Proposal for a New Course

Course number	: CS 520
Course Name	: Introduction to Quantum Computing
Credit	: 2-0-1-3
Distribution	: L-T-P-C
Intended for	: M.Tech/Ph.D./B.Tech 3rd/4th year.
Prerequisite	: Basic Linear Algebra and Probability

1. Preamble:

This course embark on a journey into the fascinating realm where bits can exist in multiple states simultaneously and computational power defies classical limitations. In this course, we will assume the foundational principles of quantum mechanics and explore how they underpin the revolutionary field of quantum computing. From qubits and superposition to entanglement and quantum algorithms, we will be able to deliver deep understanding of the fundamental concepts driving the next generation of all aspects of computing technology. This course offers basic understanding of the quantum world which will make foundational basis of quantum algorithms and cryptography.

2. Course Modules with quantitative lecture hours:

1. Introduction : Review of Linear Algebra, Probability, Qubits, Interference, Superposition, Entanglement, Young double slit, Mach-Zehnder Experiment, Dirac Notation, Postulates of Quantum Mechanics. [8 hours]
2. Quantum Computation: Universal Quantum gates, CNOT gate, Tofoli gate, Fredkin gate, No-cloning theorem, Basic Deutsch's algorithm, Quantum Teleportation, BB84, Bell States, Quantum Circuits [8 hours]

3. Quantum Algorithms: Quantum parallelism, Deutsch's algorithm, Deutsch-Jozsa algorithm, Quantum Search algorithms, Grover's search, Shor's algorithm, Speeding up the solutions of NP-complete problems, Quantum Supremacy [8 hours]

4. Quantum Cryptography : Quantum key distribution, Simon's algorithm, and Cryptanalysis.[4 hours]

3. Text books:

→ Quantum Computation and Quantum Information, M A Nielsen and I L Chuang.

→ An Introduction to Quantum Computing, P Ka , R Laflamme and M Mosca.

4. References:

- https://www.cse.iitk.ac.in/users/rmittal/course_s24.php
- <http://books.google.ca/books?id=qYHTvHPvmG8C>

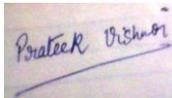
5. Justification of new course proposal if cumulative similarity content is >30%:

Approvals:

Faculty interested in teaching this course: – Dr. Prateek Vishnoi

Proposed by: Dr. Prateek Vishnoi

School: SCEE



Signature:

Date: 6th Oct 2024

The following external faculty (at least 2 faculty) provided the feedback and it was discussed among school/centre faculty on 21st Aug 2024.

S. No	Faculty Name	Signature
1	Dr. Varunkumar Jaypaul	
2	Dr. Gaurav Sood	

School Chair:

School:

Date:

This proposal is reported inth Board of Academics on

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Comments of the Reviewers:

Following suggestions from the reviewer have been incorporated in the course structure.

1) Dr. Rajat Mittal (Associate Professor, IIT Kanpur)

Preamble: I generally downplay the role of quantum mechanics, we just need the postulates. The line "delve into the foundational principles of quantum mechanics" seems too much. Again the last line seems too far-fetched. There are quantum technologies like quantum measurement etc. (more physics based) where this course might not help. You might want to say all aspects of quantum computing.

1) Introduction: There are simpler experiments (Young double slit, Mach-Zehnder) to illustrate "weirdness" of quantum mechanics, Bell's inequality might be too complicated at this point (except if audience have physics background).

2) Quantum computation: You might want to cover some "attractive" applications, otherwise the first part of the course will be challenging. You can try teleportation, BB84, they can be covered early. You can even show a basic Deutsch's algo in the first part.

3) Quantum Cryptography: Quantum supremacy should be in quantum algo and not here? Even Shor's algorithm is more of quantum algorithm and not cryptography.

IIT Mandi

Proposal for a New Course

Course number : **CS-510**

Course Name : **Randomized Algorithms**

Credit : **4-0-0-4**

Distribution : **L-T-P-C**

Intended for : **M.Tech/Ph.D./B.Tech 3rd/4th year.**

Prerequisite : **Data Structures and Algorithms, Basic Discrete Probability**

1. Preamble:

This course provides an introduction to randomized algorithms, a very powerful tool in algorithm design. Randomization often leads to the simplest and/or the fastest algorithm to solve a problem. Moreover, there are some problems for which no efficient deterministic algorithm is known.

2. Course modules with quantitative lecture hours:

1. **Introduction:** review of discrete probability, Introduction to randomized algorithms, basic examples: Polynomial Identity Testing, matrix product verification (Frievald's algorithm), Karger's randomized min-cut algorithm, randomized quicksort.
[8 hours]
2. **Concentration inequalities:** Markov's and Chebychev's inequalities, randomized selection, two-point sampling, stable marriage problem, coupon collector's problem, birthday paradox, balls and bins, Chernoff bound, application to error reduction and network routing.
[8 hours]
3. **Markov chains and random walks:** randomized algorithm for 2SAT, Markov chains, random walks on graphs, graph connectivity, expander graphs and randomly mixing random walks, probability amplification using random walks on expander graphs.
[9 hours]

4. **Randomized data structures:** random treaps, skip lists, hash tables, universal family of hash functions, perfect hashing.
[8 hours]
5. **Randomized computational geometry:** randomized incremental construction, convex hull construction, geometric duality, half space intersections, Delaunay triangulation, trapezoidal decomposition, random sampling, linear programming.
[8 hours]
6. **Randomized graph algorithms:** all pairs shortest paths, minimum-cut, minimum spanning trees.
[7 hours]
7. **Online algorithms:** adversary models, paging against oblivious and adaptive adversaries, the k-server problem.
[6 hours]
8. **Randomized Complexity classes:** RP, co-RP, ZPP, BPP.
[2 hours]

3. Text books:

1. R. Motwani and P. Raghavan, Randomized Algorithms, Cambridge University Press, 1995.
2. M. Mitzenmacher and E. Upfal, Probability and Computing: Randomization and probabilistic techniques in algorithms and data analysis, 2nd ed., Cambridge University Press, 2017.
3. S. P. Vadhan, Pseudorandomness, Now Publishers, 2012.

4. References:

1. D. P. Dubhashi and A. Panconesi, Concentration of Measure for the Analysis of Randomized Algorithms, Cambridge University Press, 2009

5. Justification of new course proposal if cumulative similarity content is >30%:

Approvals:

Faculty interested in teaching this course:- Dr. Gaurav Sood

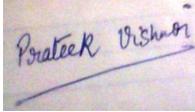
Proposed by: Dr Gaurav Sood

School: SCEE

Signature: 

Date: 6 October 2024

The following external faculty (at least 2 faculty) provided the feedback and it was discussed among school/centre faculty on 21 August 2024.

Sl. No	Faculty Name	Signature
1	Dr. Varunkumar Jayapaul	
2	Dr. Prateek Vishnoi	

School Chair:

School:

Date:

This proposal is reported inth Board of Academics on

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Comments of the Reviewers:

IIT Mandi
Proposal for a New Course

Course number : PH 550
Course Name : Introduction to Quantum Optics
Credit : 3
Distribution : 0-0-0-3
Intended for : UG/PG/PhD/PhD
Prerequisite : Basics of Quantum Mechanics , Classical Electrodynamics ,Mathematical Methods for Physics.
Mutual Exclusion : None

1. Preamble:

Quantum optics explores the quantum mechanical properties of light and its interaction with matter. This course introduces students to the foundational concepts of quantum optics, including semiclassical and fully quantum treatments of light-atom interactions, photon statistics, quantization of the electromagnetic field, and modern quantum technologies such as cavity quantum electrodynamics (QED) and single-photon sources.

Course Objectives:

By the end of the course, students should be able to:

- Understand and apply semi classical models of light-atom interaction.
- Quantize the electromagnetic field and describe light in terms of quantum states.
- Analyze photon statistics and classify light based on its quantum properties.
- Understand the principles of cavity quantum electrodynamics (QED) and explore experimental realizations of quantum optical phenomena.

2. Course Modules with quantitative lecture hours:

Module 1: Two-Level Atom System (8 lectures)

- Oscillating dipoles and Bloch sphere representation
- Density Operator and Density Matrix formalism
- Optical Bloch Equations
- Rabi Frequency and Spontaneous Decay
- Lineshape in Fluorescence and Saturation Broadening

Module 2: Quantization of the Electromagnetic Field (14 lectures)

- Quantized Modes and Operators
- Ladder Operators, Number Operator, and Quadrature Operators
- Quantization of the Electromagnetic Field
- Hamiltonian of Radiation Field and Vacuum State Energy
- Fock States, Coherent States, and Squeezed States
- Thermal States and Planck's Black Body Radiation Formula

Module 3: Photon Statistics and Measurement (10 lectures)

1. Photon Statistics

- Poissonian, Sub-Poissonian, and Super-Poissonian light
- Intensity interferometer and Hanbury Brown–Twiss experiments
- Second-order correlation function, $g_2(t)$
- Photon bunching and antibunching phenomena
- Coherent, Bunched, and Antibunched light

2. Experimental Demonstrations

- Photon antibunching experiments
- Single-photon sources and their application in quantum technologies

Module 4: Atoms in Cavities (10 lectures)

1. Optical and Microwave Cavities

- Fundamentals of Optical Cavities
- Microwave Cavities and Rydberg Atoms

2. Atom-Cavity Coupling

- Weak coupling regime and the Purcell Effect
- Experimental observations of the Purcell Effect
- Strong coupling regime and Cavity QED
- Experimental observation of strong coupling in cavities

Laboratory/practical/tutorial Modules: Not applicable.

3. Text books:

1. "Quantum optics "by Scully, M. O., & Zubairy, M. S..
2. "Introductory Quantum Optics" by Christopher Gerry and Peter Knight
3. "Quantum Optics" by Mark Fox
4. "Optical Coherence and Quantum Optics" by Leonard Mandel and Emil Wolf

4. Similarity with the existing courses: (Not applicable) (Similarity content is declared as per the number of lecture hours on similar topics)

S. No.		Course Code	Similarity Content	Approx. % of Content
1.				

6. Justification of new course proposal if cumulative similarity content is >30%:

Not applicable.

Approvals:

Faculty interested in teaching this course: – Dr. Pradyumna Pathak, Dr. Ravindra Kumar Yadav.

Proposed by: Dr. Pradyuman Pathak, Dr. Ravindra Kumar Yadav.

School: School of Physical Sciences

Signature: Ravindra Kumar Yadav

Date: 10/10/2024

The following faculty (at least 3 faculty) discussed on...08/10/2024.....and approved the proposal on...08/10/2024.....

Sl. No	Faculty Name	Signature
1.	Dr. Arko Roy	
3.	Dr. Hari Verma	
4.	Dr. C S Yadav	
5.	Dr. Kishna Mohan Parattu	
6.	Dr. Amal Sarkar	

School Chair: Prof. Bindu Radhamany

School: School of Physical Sciences.

Date: 10/10/2024

This proposal is reported in ...57.....th Board of Academics on
...10/10/2024.....

Dean Academics

Date: 10/10/2024

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi
Proposal for a New Course

Course number	: PH579
Course Name	: Quantum Computation and Information
Credit	: 3
Distribution	: 3-0-0-3
Intended for	: UG/PG/I-PhD/PhD
Prerequisite	: PH513, PH301 or equivalent

Mutual Exclusion: None

1. Preamble: This course on Quantum Information and Computing is designed to equip B.Tech, MSc, and PhD students with foundational and advanced concepts in quantum mechanics, quantum computing algorithms, and quantum information theory. For B.Tech and MSc students, the course offers an opportunity to bridge classical computing principles with quantum technologies, fostering skills relevant to emerging fields like cryptography, machine learning, and data security. PhD students can benefit from in-depth exploration of quantum algorithms, error correction, and cryptographic protocols, paving the way for research and innovation in quantum computation, theoretical physics, and quantum hardware development.

2. Course Modules with quantitative lectures

Module 1: Foundations of Quantum Computing (Lectures 1–10)

Introduction to Quantum Computing, Review of linear vector spaces, Review of

Quantum postulates, Qubits and Bloch Sphere, Basic Quantum Gates, Quantum Circuits, Quantum No-Cloning Theorem and Teleportation, Quantum Teleportation Protocol, Quantum Dense Coding, Density Matrix I.

Module 2: Advanced Quantum Concepts (Lectures 11–20)

Density Matrix II, Projective Measurement, Positive Operator-Valued Measure (POVM), EPR Paradox and Bell's Inequalities I, Bell's Inequalities II, Deutsch Algorithm, Deutsch-Jozsa Algorithm, Simon's Problem, Grover's Search Algorithm I, Grover's Search Algorithm II.

Module 3: Quantum Algorithms and Applications (Lectures 21–30)

Grover's Search Algorithm III, Grover's Search Algorithm IV, Quantum Fourier Transform I, Quantum Fourier Transform II, Period Finding Problem, Method of Continued Fractions, Shor's Factorization Algorithm I, Shor's Factorization Algorithm II, Quantum Error Correction Codes I, Quantum Error Correction Codes II.

Module 4: Quantum Information Theory and Cryptography (Lectures 31–39)

Classical Information Theory, Shannon Entropy I, Shannon Entropy II, Von Neumann Entropy I, Von Neumann Entropy II, Classical Cryptography, RSA Algorithm, Quantum Cryptography: BB84 Protocol, Quantum Cryptography: B92 and Eckert Protocol.

Module 5: Advanced Topics in Quantum Computing (Lectures 40–42)

Practical Realization of Quantum Computers, Future of Quantum Computing, Introduction to Quantum Simulators (QISKIT, etc.)

Laboratory/practical/tutorial Modules:

Not Applicable

3. Text books:

1. Michael A. Nielsen and Issac L. Chuang, "Quantum Computation and Information, Cambridge (2002).
2. Mikio Nakahara and Tetsuo Ohmi, "Quantum Computing", CRC Press (2008).
3. N. David Mermin, "Quantum Computer Science", Cambridge (2007).

3. Similarity with the existing courses:

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Course Code	Similarity Content	Approx. % of Content
1.	PH513	Postulates of QM	5%
2.	PH 301	Qubits and logic gates	5%
3.			

4. Justification of new course proposal if cumulative similarity content is >30%:

Not Applicable.

Approvals:

Faculty interested in teaching this course: Gargee Sharma, Krishnamohan Parattu, Hari Varma, Arti Kashyap.

Proposed by: Gargee Sharma, Krishnamohan Parattu, Hari Varma, Arti Kashyap.

School: School of Physical Sciences

Signature:

Date: 08/10/2024

The following faculty (at least 3 faculty) discussed on Oct 7, 2024 and approved the proposal on Oct 8, 2024.

Sl. No	Faculty Name	Signature
1.	Arko Roy	
2.	Harsh Soni	
3.	Nirmalya Kajuri	

School Chair: Dr. Bindu Radhamany

School: SPS

Date:

This proposal is reported in XXnd Board of Academics on XX date.

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC CourseCode.

IIT Mandi Proposal for a New Course

Course number : HS110
Course Name : Japanese Language for Beginners
Credit : 3
Distribution : L-T-P-C
Intended for : UG, PG
Prerequisite :
Mutual Exclusion: (Specify the equivalent courses in other schools. These *Courses (with high similarity) are not allowed to credit by the students after or along with this course.*)

1. Preamble:

This course introduces students to the Japanese language, and helps students to acquire Japanese grammar, characters and vocabulary, and to develop multiple skills such as listening, reading, writing and speaking comprehensively.

After taking this course, you will be able to

- Understand and use familiar everyday expressions and basic phrase.
- Introduce yourself and others.
- Ask and answer questions about personal details.
- Interact slowly and simply.
- Read Japanese characters (hiragana, katakana, and some basic kanji).
- Acquire JLPT N5 level grammar and vocabulary.
- Cultivate intercultural understanding
- Develop a deeper understanding of the Japanese culture and your own culture by comparing and contrasting them with each other.

2. Course Modules with quantitative lecture hours:

Classes are conducted according to the textbook 'Marugoto'.

Marugoto focuses on communication using Japanese and consists of scene syllabus. It systematically introduces the sentence patterns, grammar, vocabulary and kanji step by step showing every situation where these things are actually used.

Each lesson provides opportunities to read sentences, understand grammar, practice pronunciation, solve listening comprehension questions and sometimes write sentences in Japanese.

About 50 kanji characters are introduced, and a worksheet is provided separately in class to give students the opportunity to practice writing them.

The course also includes a number of questions that offer an opportunity to understand Japanese culture and can be discussed with learners in class.

The textbook Minna no Nihongo and its supplementary materials are also used as part of the main textbook as appropriate.

[Time of lectures]

The first session is Introduction (1 hour).

Lessons 1 to 6 are scheduled for three hours each, with the lecture of two types of characters. (18 hours)

Lessons 7 to 16 are scheduled for two hours each. (20 hours)

Exams (or assignments) are given in the middle and at the end of the semester. (3 hours)

(Total of 42 hours planned.)

[Title and Contents of lectures]

Lesson 1 – Hello: Exchange greetings

Lesson 2 – Would you say that again?: Use basic classroom expressions

Lesson 3 – Nice to meet you: Give a simple self introduction

Lesson 4 – There are three people in my family: Talk briefly about your family

Lesson 5 – What kind of food do you like?: Talk about your favorite foods

Lesson 6 – Where are you going to have lunch today?: Say what your favorite dish is

Lesson 7 – There are three rooms in my home: Say what kind of home you live in

Lesson 8 – It s a nice room: Ask/Say where to put things in the room

Lesson 9 – What time do you get up?: Say the time you do something

Lesson 10 – When is convenient for you?: Talk about your schedule for this week

Lesson 11 – What s your hobby?: Talk about your hobbies

Lesson 12 – Shall we go together?: Recognize information on posters and calendars for events

Lesson 13 – How are you going to get there?: Recognize station and taxi signs

Lesson 14 – It s a famous temple: Say how to get to a destination

Lesson 15 – Cute!/: Talk about what you want to buy

Lesson 16 – I ll take this: Make a brief comment on things in a shop

Laboratory/practical/tutorial Modules:

3. Text books:

The Japan Foundation, *MARUGOTO: Japanese language and culture Starter A1 Coursebook*, SANSYUSYA, Japan, 2013

3A corporation, *Minna no Nihongo Elementary*, 3A corporation, Japan, 2012

4. References:

1. Arc academy, *Hajimete No Nihongo Nouryoku Shiken N5 Tango 1000 (English/ Vietnamese Edition)*, ASK Publishing, Japan, 2017
2. Kyoko Igarashi, *The Best Complete Workbook for the Japanese-Language Proficiency Test N5 – Language Knowledge (Vocabulary/Grammar), Reading & Listening*, The Japan Times Publishing, Japan, 2022
3. The Japan Foundation, *IRODORI-Japanese for Life in Japan-*, The Japan Foundation, Japan, 2020

5. Similarity with the existing courses:

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.		Course Code	Similarity Content	Approx. % of Content
1.	Japanese for Daily Life		There is overlapping of initial content of learning.	50

6. Justification of new course proposal if cumulative similarity content is >30%:

Japanese for Daily Life” is designed for those who wish to develop basic Japanese language skills, with particular emphasis on oral communication skills.

It provides a great deal of opportunity to develop listening skills, learn frequently used oral expressions and practice conversational interactions.

Japanese Language Class for Beginner” aims to develop the four skills of reading, listening, writing and speaking. Classes include not only the development of oral communication skills, but also learning to read and write Japanese characters and grammar. Students develop the basic skills needed to use Japanese appropriately in a variety of situations.

Approvals:

Faculty interested in teaching this course: –

Proposed by: Hinaho Kishi

School: SHSS

Signature:

Date: 09.10.2024

The following external faculty (at least 2 faculty) provided the feedback and it was discussed among school/centre faculty on.....

Sl. No	Faculty Name	Signature
1	Prof. Janashruti Chandra, JNU	
2	Prof. M.V. Lakshmi, JNU	
3	Prof. Dinamani, JNU	

School Chair:

School:

Date:

This proposal is reported inth Board of Academics on

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Comments of the Reviewers:

IIT Mandi

Proposal for a New Course

Course number : HS111

Course Name : Japanese Language for Daily Life

Credit : 3

Distribution : L-T-P-C

Intended for : B.Tech

Prerequisite : NA

Mutual Exclusion: (Specify the equivalent courses in other schools. These Courses (with high similarity) are not allowed to credit by the students after or along with this course.)

1. Preamble:

This course introduces students to the Japanese language.

After taking this course, you will be able to :

- Speak in a way that is easily understood by others*
- Asking back and asking questions when you don't understand*
- Use formal and casual Japanese appropriately depending on the situation*
- Memorize and use commonly used business Japanese (phrases)*
- Answer simple questions that can be expected in an interview*
- Understand cultural differences between Japan and India, and how to work collaboratively with others when working in a Japanese company*
- Discover the advantages you have*

2. Course Modules with quantitative lecture hours:

Hiragana-Katakana (20 min at the beginning of each lesson)

Introduction: (1 Hours)

Unit 01: Self-introduction (5 Hours)

Unit 02: Daily conversation (3 Hours)

Unit 03: Interview Etiquette (1 Hours)

Unit 04: Socializing | - Making small talk (3 Hours)

Unit 05: Present and past tenses (6 Hours)

Unit 06: Talking about plans and activities (6 Hours)

Unit 07: Socializing II - Invitations (5 Hours)

Unit 08: Taste words & politely refuse foods you don't like/don't eat (3 Hours)

Unit 09: Talking about impressions (3 Hours)

Unit 10: Making request, get permission (6 Hours)

Total of 42 hours planned.

Laboratory/practical/tutorial Modules:

3. Text books:

- 1. Yukiko Ogata, Nihongo Fun & Easy: Survival Japanese Conversation for Beginners, ASK Publishing, Japan, 11DEC2009**
- 2. Kiyomi Ogawa, Orrin Cummins, YASANICHI MANGA JAPAN GUIDE, IBC Publishing, Japan, JUN2022**
- 3. Yoji Yamakuse, Michael A. Coony, Heart & Soul of the Japanese, IBC Publishing, Japan, 20DEC2023**
- 4. Atusko Tokui, Tabunka kyousei no Komyunike-shon: Nihongo kyouiku no genba kara, ALC Publishing, Japan, 08APR2020**
- 5. Erin Meyer, THE CULTURE MAP, Public Affairs, 28JUN2016**
- 6. MARUGOTO Plus (Online) <https://marugotoweb.jp/ja/index.php>**
- 7. TSUNAHIRO (Online) <https://tsunagaru.jp.mext.go.jp/>**
- 8. 3A corporation, Minna no Nihongo Elementary, 3A corporation, Japan, 2012**

4. References:

Kyoko Igarashi. (2022). The Best Complete Workbook for the Japanese-Language Proficiency Test N5 – Language Knowledge (Vocabulary/Grammar), Reading & Listening. The Japan Times Publishing.
ATSUKO TOKUI. (2020). Revised Edition Multicultural Communication. ALC PRESS

5. Similarity with the existing courses:

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.		Course Code	Similarity Content	Approx. % of Content
1.	Japanese Language Class for Beginner		There is overlapping of initial content of learning	50%

6. Justification of new course proposal if cumulative similarity content is >30%:

Japanese for Daily Life Class is designed for those who wish to develop basic Japanese language skills, with particular emphasis on oral communication skills. It provides a great deal of opportunity to develop listening skills, learn frequently used oral expressions and practice conversational interactions.

Japanese Language Class for Beginner aims to develop the four skills of reading, listening, writing and speaking. Classes include not only the development of oral communication skills, but also learning to read and write Japanese characters and grammar. Students develop the basic skills needed to use Japanese appropriately in a variety of situations.

Approvals:

Faculty interested in teaching this course: –

Proposed by: Moena Watanabe

School: SHSS

Signature:

Date: 09.10.2024

The following external faculty (at least 2 faculty) provided the feedback and it was discussed among school/centre faculty on.....

Sl. No	Faculty Name	Signature
1	Prof. Janashruti Chandra, JNU	

2	Prof. M.V. Lakshmi, JNU	
3	Prof. Dinamani, JNU	

School Chair:

School:

Date:

This proposal is reported inth Board of Academics on

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Comments of the Reviewers: